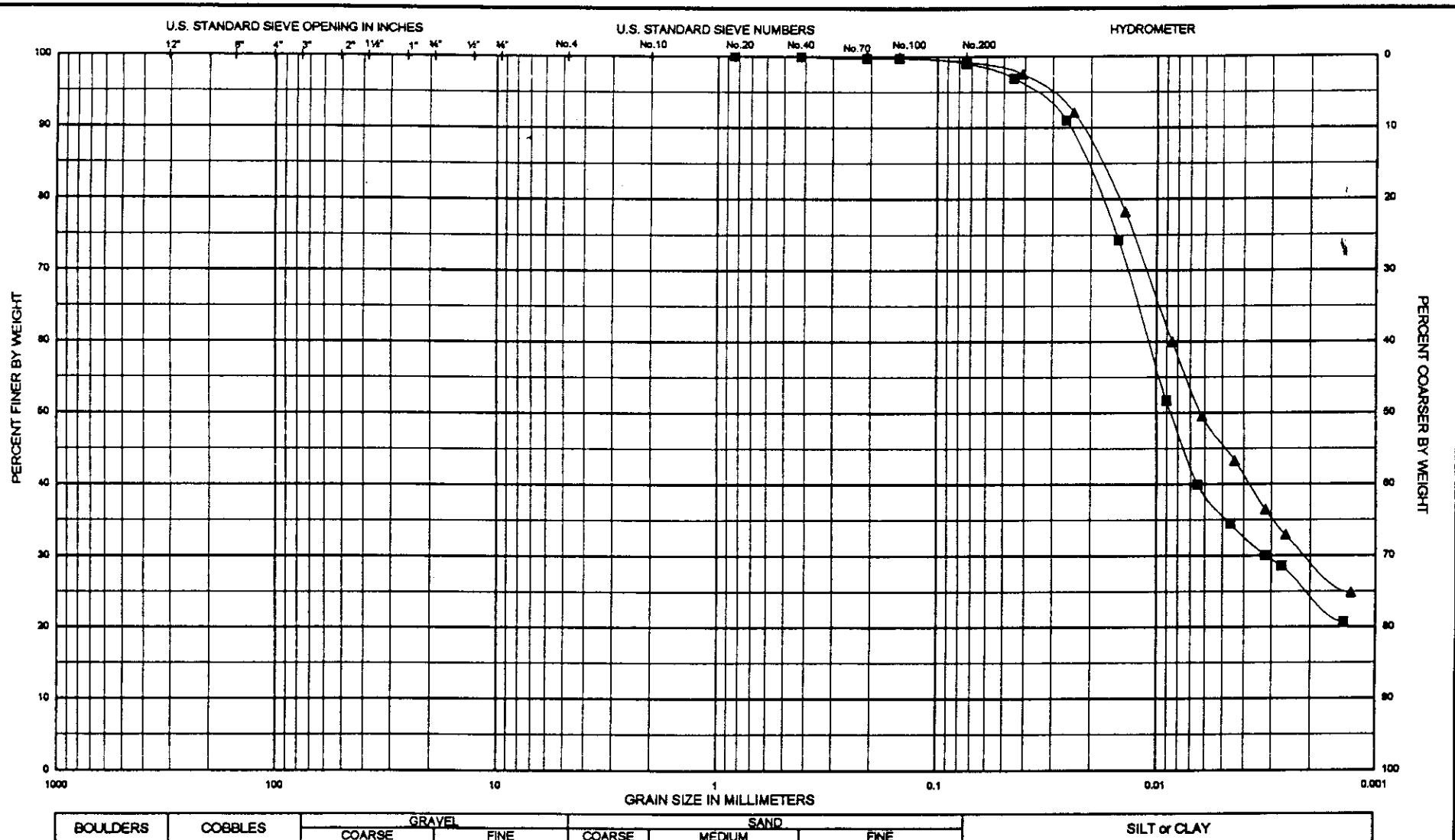


EA Appendix V

Sediment Data; Sediment Borings

**SUMMARY OF SOIL LABORATORY TESTING
TOLCHESTER CHANNEL REALIGNMENT**

Boring Number	Sample Depth – ft.	Soil Description	Atterberg Limits	
			Liquid Limit	Plastic Limit
DH-1	32.2 to 36.3	Fat Clay (CH), trace sand, flounder	95	58
DH-1	38.3 to 40.3	Organic Clay (OH)	81	36
DH-2	29.6 to 31.6	Fat Clay (CH)	91	36
DH-2	37.6 to 39.6	Fat Clay (CH)	81	33
DH-3	36.5 to 38.5	Fat Clay (CH)	77	32
DH-3	44.5 to 46.5	Fat Clay (CH)	89	35
DH-4	25.1 to 29.1	Fat Clay (CH), trace sand	92	34
DH-4	41.1 to 43.1	Fat Clay (CH)	78	33
DH-5	29.3 to 31.3	Fat Clay (CH), trace sand	88	36
DH-5	39.3 to 41.3	Fat Clay (CH)	89	34
DH-6	26.2 to 28.2	Organic Clay (OH), trace sand	80	35
DH-6	42.2 to 44.2	Fat Clay (CH), trace sand	103	35
DH-7	25.1 to 27.1	Organic Clay (OH)	83	34
DH-7	31.1 to 27.1	Fat Clay (CH)	89	33
DH-8	31.8 to 33.8	Fat Clay (CH)	84	35
DH-8	41.8 to 43.8	Fat Clay (CH)	79	32
DH-9	35.3 to 37.3	Fat Clay (CH), trace sand	84	34
DH-9	43.3 to 45.3	Fat Clay (OH)	81	34
DH-10	40.1 to 42.1	Fat Clay (CH), trace sand	90	36
DH-10	44.1 to 46.1	Fat Clay (CH), trace gravel	75	32



BOULDERS	COBBLES	GRAVEL	SAND	SILT or CLAY				
		COARSE	FINE	COARSE	MEDIUM	FINE		
—■—	Jar-1&2	32.3-36.3	Fat clay (tr. sand)	(CH)	138.0	95	37	58
—▲—	"	"	L.O.I. = 8.3% - Inorganic					
—▲—	Jar-4	38.3-40.3	Organic clay	(OH)	113.1	81	36	45
—▲—	"	"	L.O.I. = 12.0% - Organic					

ENG FORM 2087

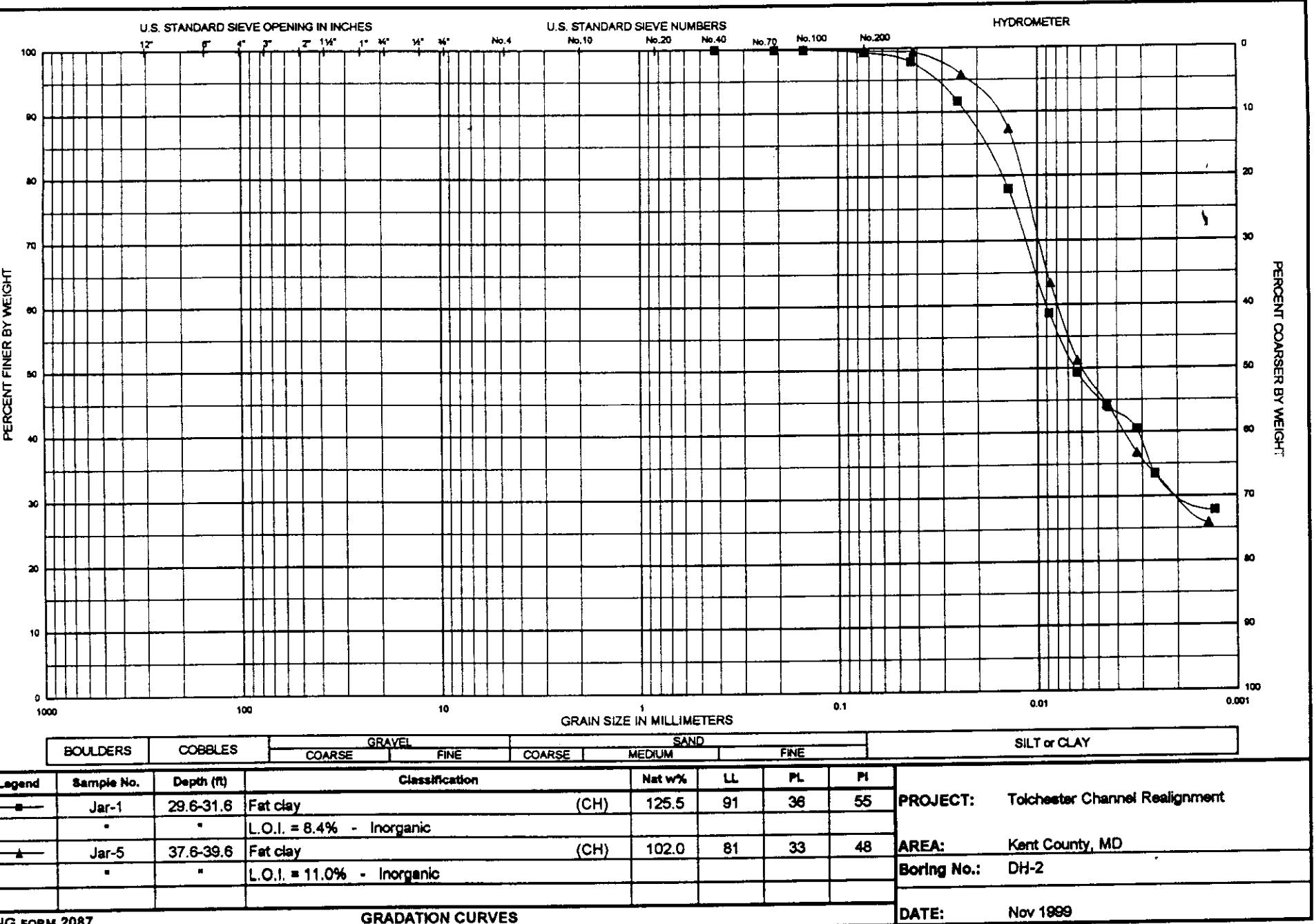
GRADATION CURVES

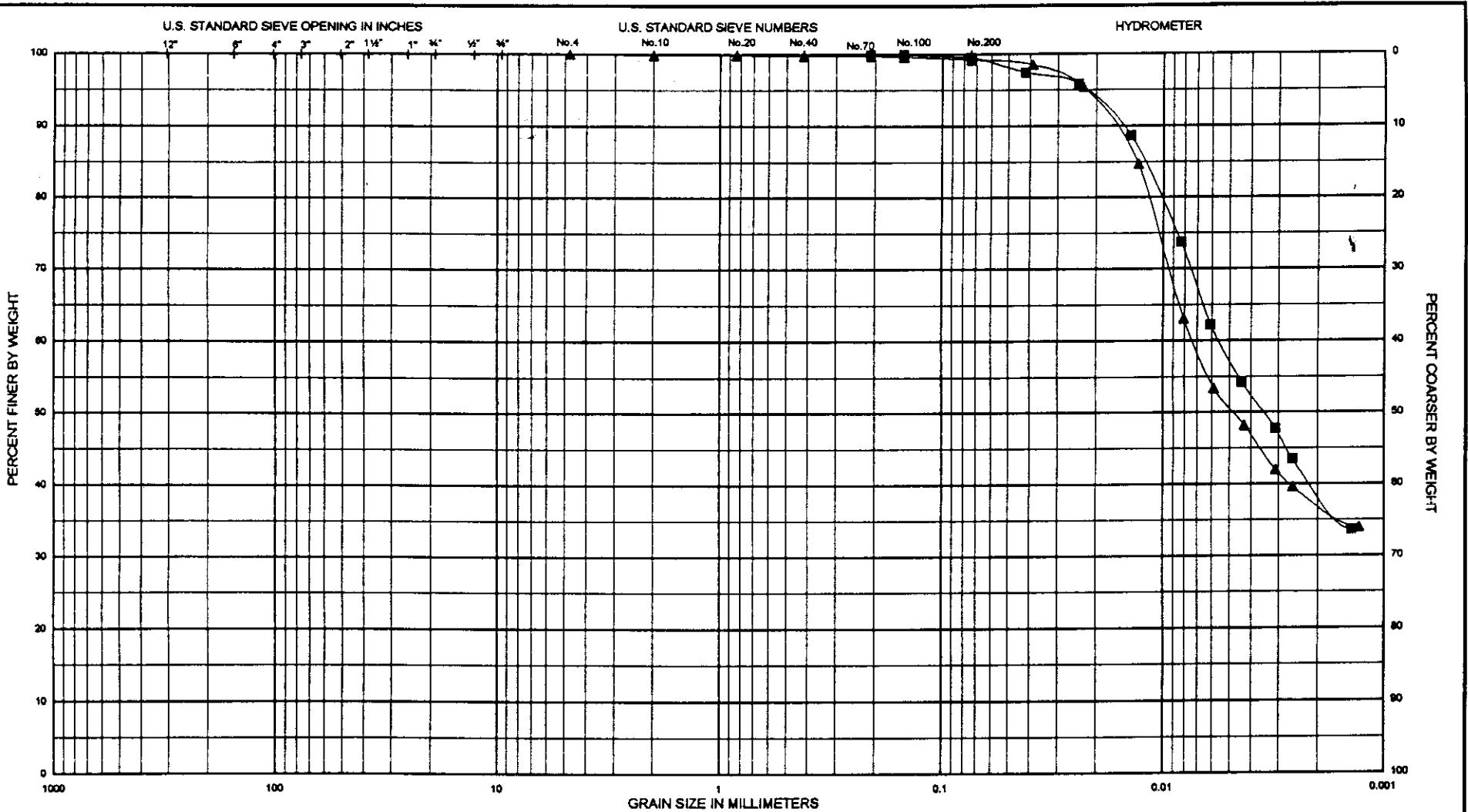
PROJECT: Tolchester Channel Realignment

AREA: Kent County, MD

Boring No.: DH-1

DATE: Nov 1999

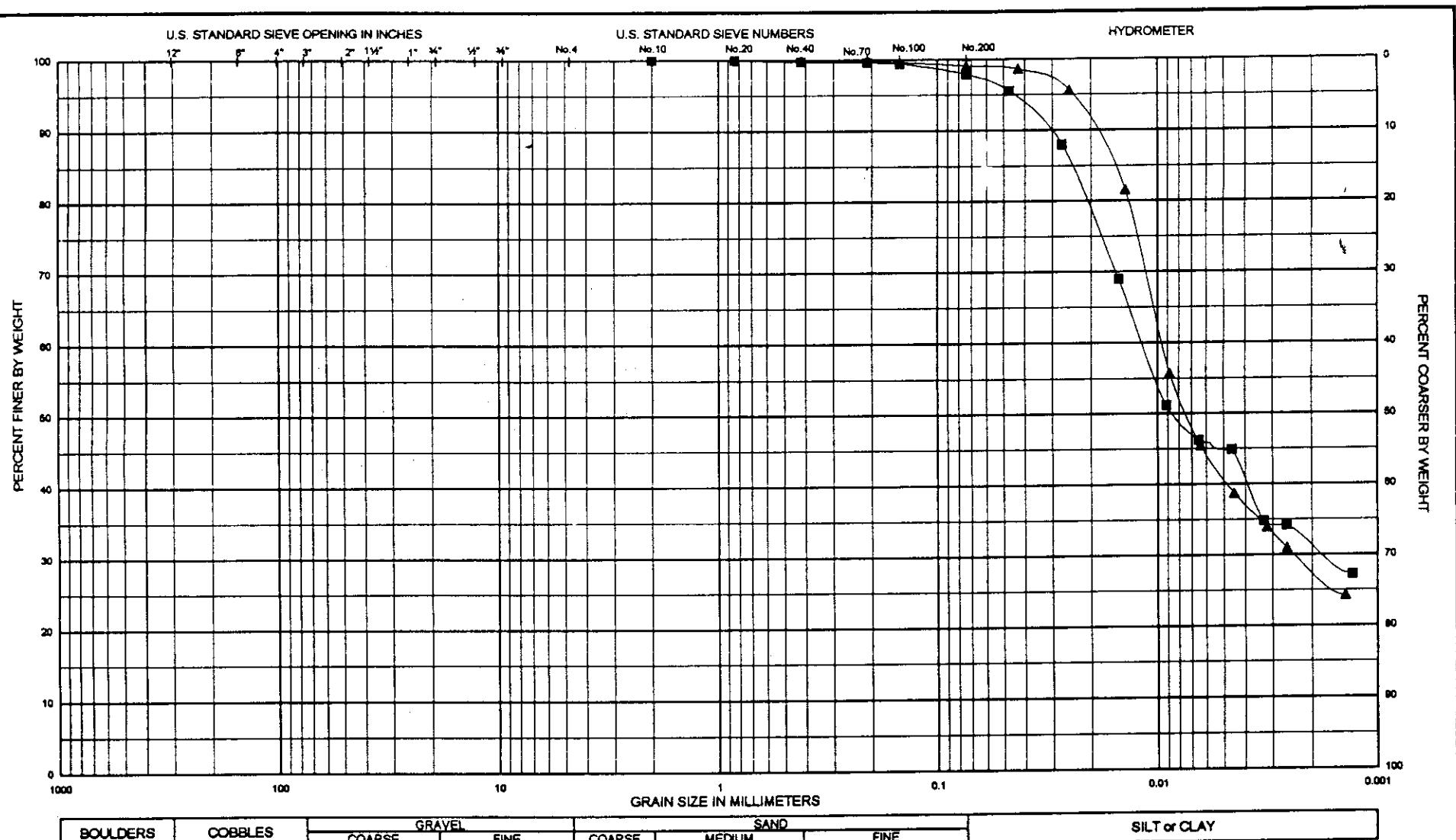




BOULDERS	COBBLES	GRAVEL		SAND			SILT or CLAY	
		COARSE	FINE	COARSE	MEDIUM	FINE		
—▲—	Jar-6	36.5-38.5	Fat clay	(CH)	108.1	77	32	45
—■—	—	—	L.O.I. = 9.1% - Inorganic					
—▲—	Jar-10	44.5-48.5	Fat clay	(CH)	108.2	89	35	54
—■—	—	—	L.O.I. = 9.0% - Inorganic					

Legend: —▲— Jar-6; —■— Jar-10

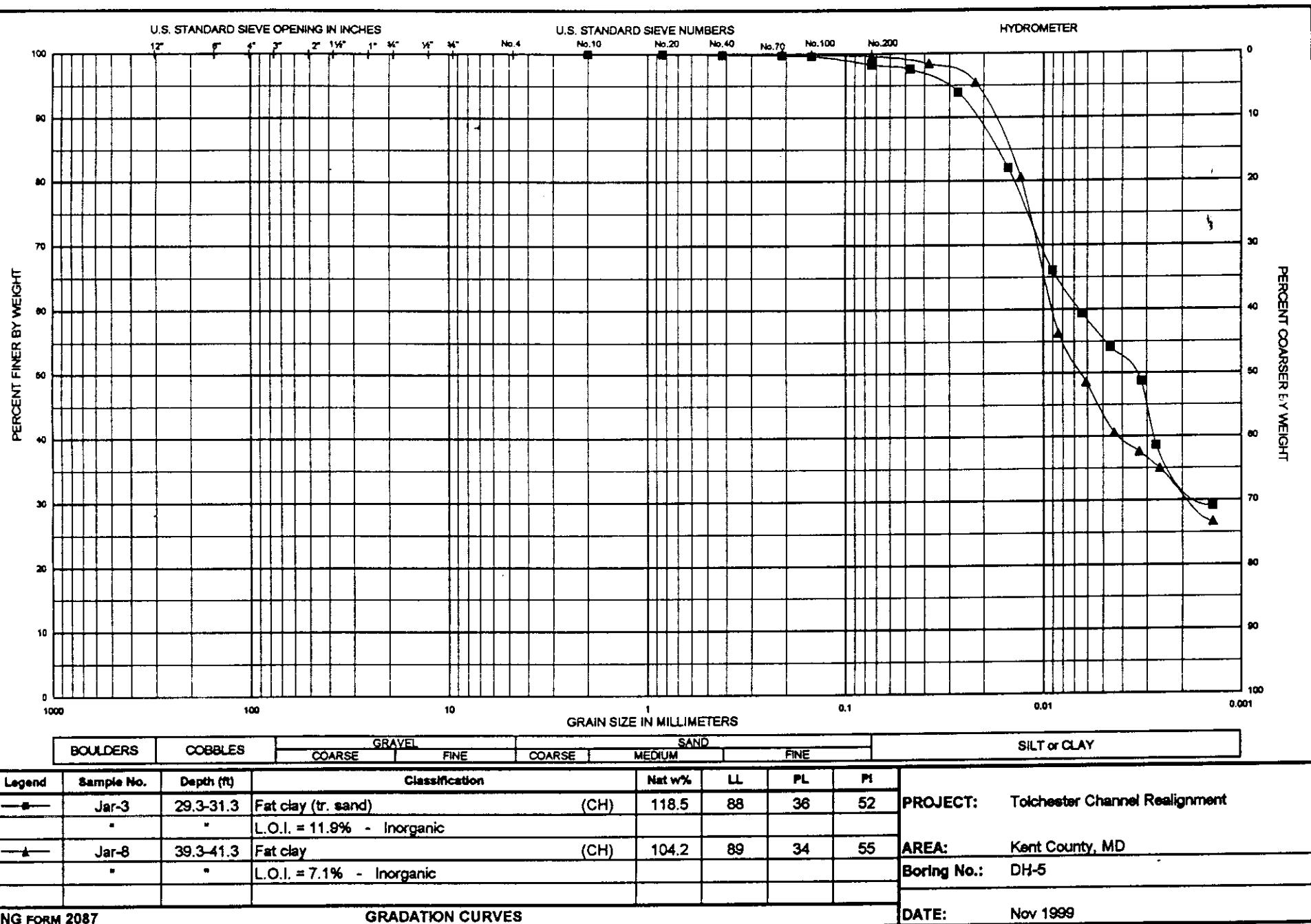
PROJECT: Tolchester Channel Realignment
AREA: Kent County, MD
Boring No.: DH-3
DATE: Nov 1999

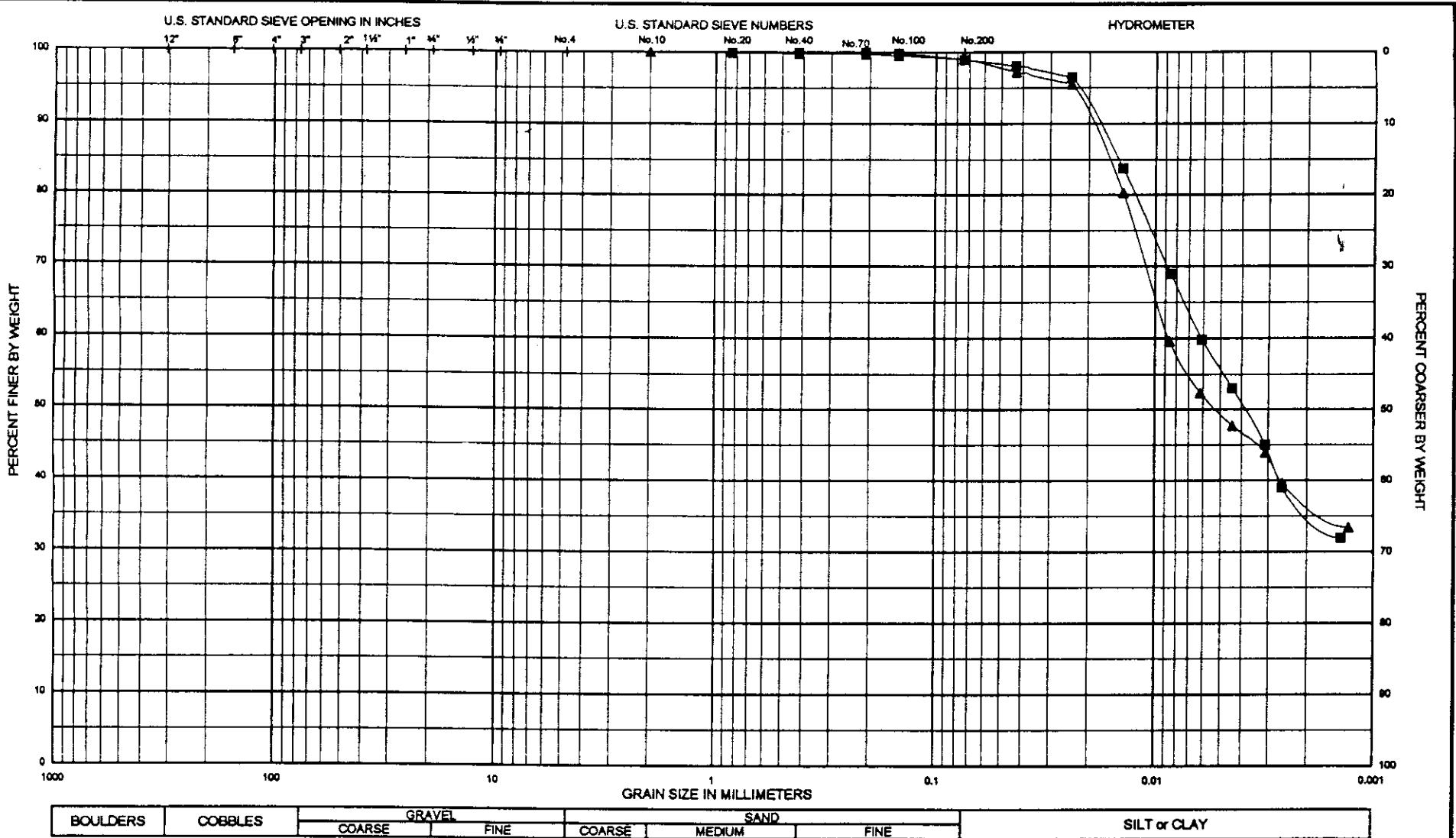


BOULDERS	COBBLES	GRAVEL		SAND			SILT or CLAY	
		COARSE	FINE	COARSE	MEDIUM	FINE		
—■—	Jar-1&2	25.1-29.1	Fat clay (tr. sand)	(CH)	128.9	92	34	58
	*	*	L.O.I. = 8.5% - Inorganic					
—▲—	Jar-9	41.1-43.1	Fat clay	(CH)	100.5	78	33	45
	*	*	L.O.I. = 7.3% - Inorganic					

Legend: —■— Jar-1&2, —▲— Jar-9

PROJECT: Tolchester Channel Realignment
AREA: Kent County, MD
Boring No.: DH-4
DATE: Nov 1999





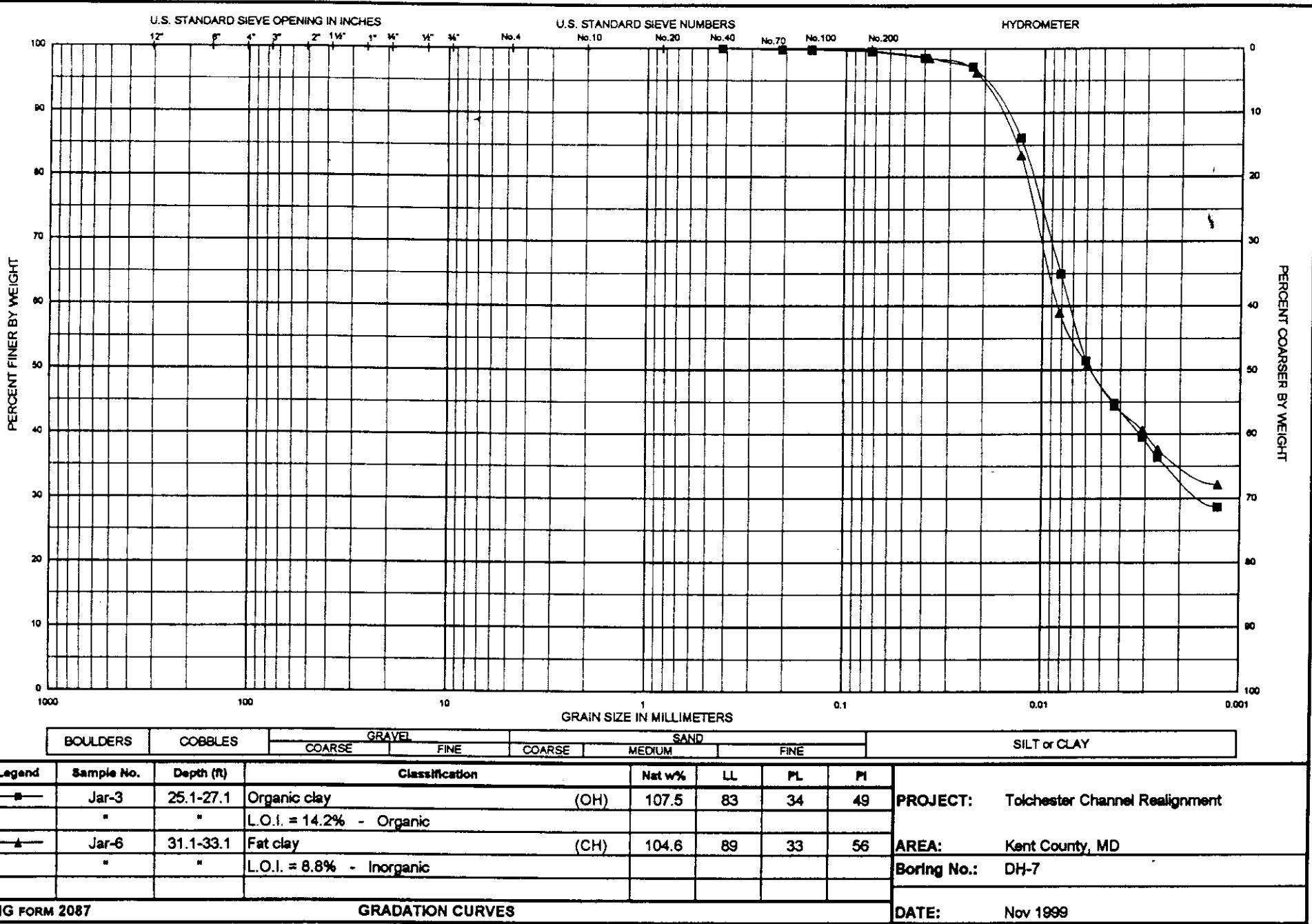
BOULDERS	COBBLES	GRAVEL	SAND			SILT or CLAY		
			COARSE	FINE	COARSE	MEDIUM	FINE	
Legend	Sample No.	Depth (ft)	Classification	Nat w%	LL	PL	PI	
■	Jar-3	26.2-28.2	Organic clay (tr. sand) L.O.I. = 14.0% - Organic	(OH)	109.9	80	35	45

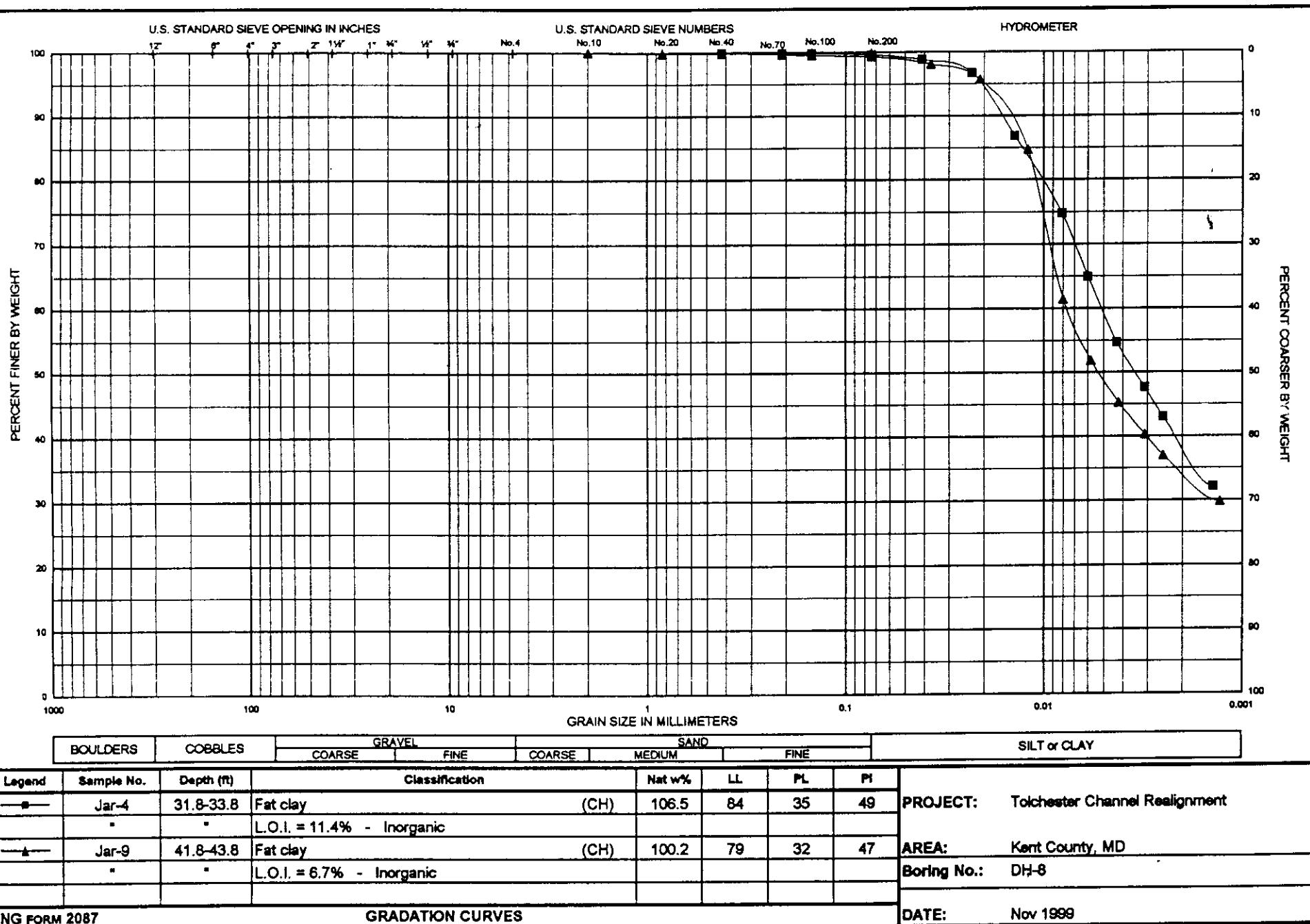
PROJECT: Tolchester Channel Realignment

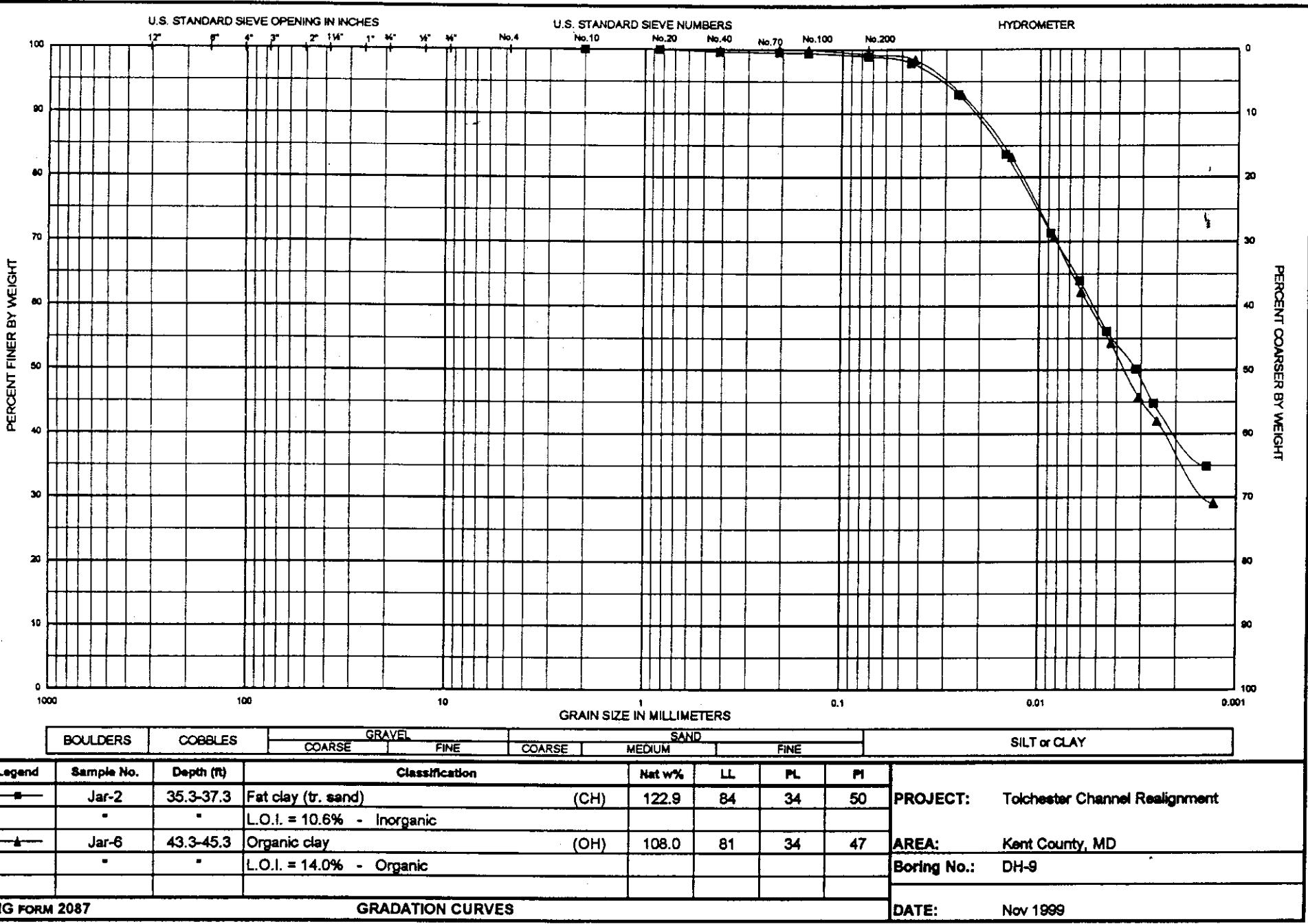
AREA: Kent County, MD

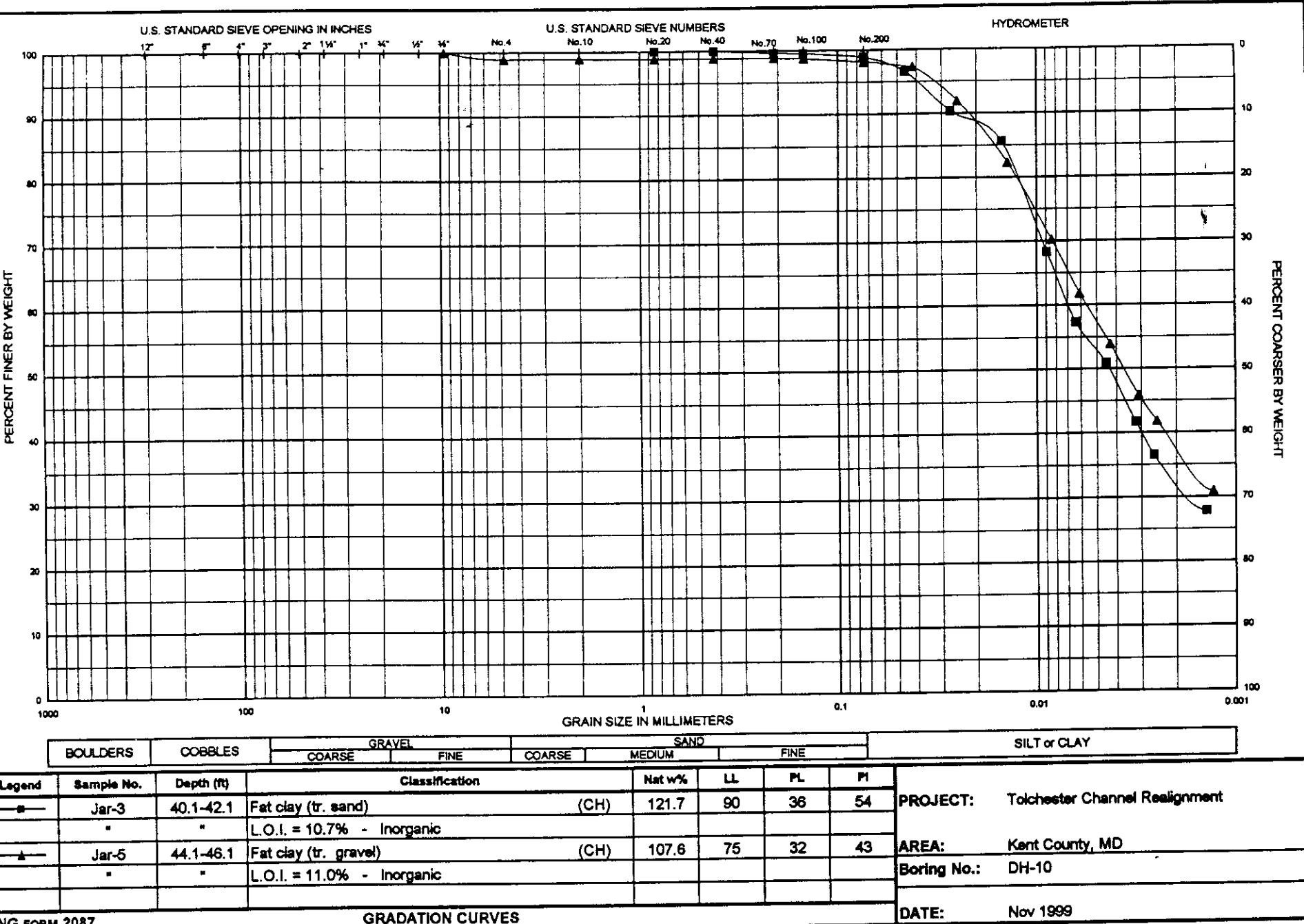
Boring No.: DH-6

DATE: Nov 1999









ORGANIC DATA QUALIFIERS

Qualifiers other than those listed below may be required to properly define the results. If used, they are given an alphabetic designation not already specified in this table or in a project/program document such as a Quality Assurance Project Plan or a contract Statement of Work. Each additional qualifier is fully described in the Analytical Narrative section of the laboratory report.

- U** Indicates a target compound was analyzed for but not detected. The sample Reporting Limit (RL) is corrected for dilution and, if a soil sample, for percent moisture, if reported on a dry weight basis.
- J** Indicates an estimated value. This qualifier is used under the following circumstances:
 - 1) when estimating a concentration for tentatively identified compounds (TICs) in GC/MS analyses, where a 1:1 response is assumed,
 - 2) when the mass spectral and retention time data indicate the presence of a compound that meets the volatile and semivolatile GC/MS identification criteria, and the result is less than the RL but greater than the method detection limit (MDL).
- B** This qualifier is used when the analyte is found in the associated method blank as well as in the sample. It indicates possible/probable blank contamination and warns the data user to take appropriate action. For GC/MS analyses, this qualifier is used for a TIC, as well as, for a positively identified target compound.
- E** This qualifier identifies compounds whose concentrations exceed the calibration range of the instrument for that specific analysis.
- D** When applied, this qualifier identifies all compound concentrations reported from a secondary dilution analysis.
- A** This qualifier indicates that a TIC is a suspected aldol-condensation product.
- N** Indicates presumptive evidence of a compound. This qualifier is only used for GC/MS TICs, where the identification is based on a mass spectral library search. For generic characterization of a TIC, such as chlorinated hydrocarbon, the N qualifier is not used.
- P** When applied, this qualifier indicates a reported value from a GC analysis when there is greater than 25% difference for detected concentrations between the two GC columns.

INORGANIC DATA QUALIFIERS

C *(Concentration) qualifiers:*

- B** Reported value is less than the project-specified Reporting Limit (RL), but greater than the method-specified Instrument Detection Limit (IDL) or Method Detection Limit (MDL).
- U** Analyte analyzed for but not detected (concentration is less than the method-specified Instrument Detection Limit (IDL) or Method Detection Limit (MDL)).

Q *(Quality control) qualifiers:*

- E** Reported value is estimated because of presence of interference.
- M** Duplicate injection precision not met.
- N** Spiked sample recovery is not within control limits.
- S** Reported value is determined by the method of standard additions (MSA).
- W** Postdigestion spike for furnace Atomic Absorption Spectrophotometric (AAS) AAS analysis is out of control limits (85-115%) and sample absorbance is less than 50% of spike absorbance.
- * Duplicate analyses is not within control limits.
- + Correlation coefficient for MSA is less than 0.995.

M *(Method) qualifiers:*

- P** Inductively Coupled Plasma (ICP)
- A** Flame AAS
- F** Furnace AAS
- CV** Cold Vapor AAS
- AV** Automated Cold Vapor AAS
- AS** Semiautomated Spectrophotometric
- C** Manual Spectrophotometric
- T** Titrimetric
- NR** Analyte is not required to be determined.

DIOXIN AND FURAN DATA QUALIFIERS

A	Amount detected is less than the Method Calibration Limit.
E	Amount detected is over the Method Calibration Limit.
DPE	Denotes the presence of possible polychlorinated diphenyleters.
EDL	“Estimated Detection Limit”
EMPC	“Estimated Maximum Possible Concentration”
ppt	Parts-per-trillion (pg/g; ng/L)
Q	Indicated the presence of quantitative interferences. They generally result in an underestimation of the affected total homologue groups.
V	Recovery is lower than 40%. The data has been validated based upon a favorable signal-to-noise and detection limit.
B	Detected in Blank
J	Estimated value; value less than Lower Method Calibration Limit

TOLCHESTER STRAIGHTENING - SEDIMENT, ELUTRIATE, AND TISSUE DATA (1999-2000)

ANALYTE	MATRIX:			SEDIMENT			ELUTRIATE			NEREIS VIRENS TISSUE					MACOMA NASUTA TISSUE					
	Sediment Units	TLS1VC	TLS2VC	TLSVCCOMP	Elutriate Units	TLSVC-EL Sept-1999	TLSVC-EL Dec-1999	Tissue Units	TLS-A	TLS-B	TLS-C	TLS-D	TLS-E	TLS-A	TLS-B	TLS-C	TLS-D	TLS-E		
DIOXINS/FURANS																				
2,3,7,8-TCDD	NG/KG			0.36 U	NG/L		0.00262 U	NG/KG	0.0901 U	0.139 U	0.127 U	0.143 U	0.0917 U	0.194 U	0.107 U	0.18 U	0.138 U	0.172 U		
1,2,3,7,8-PECDD	NG/KG			0.78 J	NG/L		0.00109 U	NG/KG	0.0751 U	0.112 U	0.0818 U	0.0779 U	0.0688 EMPC	0.114 U	0.0933 J	0.0952 U	0.0758 U	0.0908 U		
1,2,3,4,7,8-HXCDD	NG/KG			0.69 J	NG/L		0.00463 U	NG/KG	0.143 U	0.146 U	0.128 U	0.36 EMPC	0.11 U	0.181 U	0.136 U	0.11 U	0.106 U	0.0951 U		
1,2,3,6,7,8-HXCDD	NG/KG			0.93 J	NG/L		0.00487 U	NG/KG	0.262 EMPC	0.265 J	0.13 U	0.265 EMPC	0.193 EMPC	0.17 U	0.292 J	0.243 U	0.233 EMPC	0.195 EMPC		
1,2,3,7,8,9-HXCDD	NG/KG			0.81 EMPC	NG/L		0.00439 U	NG/L	0.00368 B	NG/KG	0.131 U	0.182 EMPC	0.118 U	0.142 U	0.159 J	0.16 U	0.129 U	0.104 U	0.139 EMPC	
1,2,3,4,6,7,8-HPCDD	NG/KG			5.8	NG/L			NG/L	0.03 B	NG/KG	1.44 J	0.949 J	0.656 J	1.27 J	0.896 J	1.72 J	1.62 J	1.6 J	2.24 J	1.55 J
OCDD	NG/KG			112	NG/L			NG/L	6.83	NG/KG	6.2	3.29 J	6.27	4.91 J	17.6	18.7	23	19.6	18.1	
2,3,7,8-TCDF	NG/KG			1.7 J	NG/L		0.00101 U	NG/L	0.718 J	NG/KG	0.657 J	0.329 J	0.744 J	0.595 J	0.133 UJ	0.133 U	0.144 U	0.162 U	0.206 U	
1,2,3,7,8-PECDF	NG/KG			2.32 J	NG/L		0.00085 U	NG/L	0.166 J	NG/KG	0.129 U	0.0725 U	0.0922 U	0.0917 U	0.0911 U	0.0884 U	0.101 U	0.0672 U	0.104 U	
2,3,4,7,8-PECDF	NG/KG			4.45 J	NG/L		0.00083 U	NG/L	0.197 J	NG/KG	0.139 EMPC	0.0402 U	0.164 J	0.165 J	0.0621 U	0.0642 U	0.0697 U	0.05 U	0.0639 U	
1,2,3,4,7,8-HXCDF	NG/KG			3.18 EMPC	NG/L		0.00178 U	NG/L	0.172 J	NG/KG	0.11 U	0.091 U	0.125 U	0.136 EMPC	0.105 U	0.163 B	0.131 B	0.146 B	0.127 B	
1,2,3,6,7,8-HXCDF	NG/KG			2.63 EMPC	NG/L		0.0017 U	NG/L	0.105 J	NG/KG	0.105 U	0.0891 U	0.12 U	0.0859 U	0.0975 UJ	0.0896 U	0.0838 U	0.0831 U	0.0766 U	
2,3,4,6,7,8-HXCDF	NG/KG			2.78 J	NG/L		0.00189 U	NG/L	0.116 EMPC	NG/KG	0.121 U	0.1 U	0.134 U	0.1 U	0.112 U	0.0991 U	0.0895 U	0.112 EMPC	0.083 U	
1,2,3,7,8,9-HXCDF	NG/KG			0.55 U	NG/L		0.00208 U	NG/L	0.147 U	NG/KG	0.201 U	0.175 U	0.225 U	0.162 U	0.144 U	0.125 U	0.117 U	0.12 U	0.108 U	
1,2,3,4,6,7,8-HPCDF	NG/KG			9.02	NG/L		0.00183 U	NG/L	0.272 J	NG/KG	0.28 J	0.104 U	0.273 J	0.198 J	0.155 U	0.224 EMPC	0.212 EMPC	0.309 J	0.283 J	
1,2,3,4,7,8,9-HPCDF	NG/KG			0.61 EMPC	NG/L		0.00223 U	NG/L	0.15 U	NG/KG	0.216 U	0.183 U	0.233 U	0.126 U	0.257 U	0.116 U	0.127 U	0.107 U	0.119 U	
OCDF	NG/KG			3.13 J	NG/L		0.0082 U	NG/L	0.32 U	NG/KG	0.331 U	0.305 U	0.347 U	0.272 U	0.425 U	0.218 EMPC	0.273 U	0.276 U	0.315 J	
DIOXINS TEQ (ND=0)	NG/KG			3.6	NG/L		0	NG/L	0.23	NG/KG	0.111	0.0428	0.178	0.174	0.0348	0.111	0.039	0.0451	0.0367	
DIOXINS TEQ (ND=1/2DL)	NG/KG			3.81	NG/L		0.00295	NG/L	0.316	NG/KG	0.247	0.182	0.31	0.246	0.236	0.219	0.218	0.177	0.193	
DIOXINS TEQ (ND=DL)	NG/KG			4.02	NG/L		0.00591	NG/KG	0.402	NG/L	0.383	0.321	0.442	0.317	0.436	0.327	0.397	0.308	0.349	
INORGANIC NON-METALS																				
CYANIDE	MG/KG	0.33	0.33		MG/L		0.005 U	MG/L												
MOISTURE CONTENT	%	53.1	58.6	53.3																
NITROGEN, AMMONIA	MG/KG	72	62		MG/L	2.18	2.9													
NITROGEN, NITRATE AND NITRITE	MG/KG	0.03 U	0.03 U		MG/L	0.005 U	0.02 U													
NITROGEN, TOTAL KJELDAHL	MG/KG	193	485		MG/L	4.29	4.2													
OXYGEN DEMAND, BIOCHEMICAL	MG/KG	1740	1340		MG/L	2.8	1.7													
OXYGEN DEMAND, CHEMICAL	MG/KG	224000	202000		MG/L	466	208													
PH					PH	7.36	8													
PHOSPHORUS, TOTAL	MG/KG	408	434		MG/L	0.05 U	0.04													
SEM/AVS	RATIO	0.05	0.12																	
SULFIDE, TOTAL	MG/KG	756	1610		MG/L	0.35 U	0.35 U													
TOTAL ORGANIC CARBON	MG/KG	141000 >	131000	129000	MG/L	4.14	8 U													
PHYSICAL CHARACTERISTICS																				
CLAY	%	50	52.1	50.2																
COBBLES	%			0																
GRAVEL	%	0	0	0																
SAND	%	0.6	0.3	2.4																
SILT	%	49.4	47.6	47.4																
SILT-CLAY	%	99.4	99.7																	
SPECIFIC GRAVITY	T/4C	1.4	1.4																	
LIPIDS								%	0.351	0.291	0.405	0.368	0.381	0.088 U	0.093 U	0.09 U	0.089 U	0.09 U		
METALS																				
ALUMINUM	MG/KG	14800	14100		UG/L	164 J	176 B		MG/KG	11.6 B	11.1 B	10.4 B	9.9 B	13.4 B	32	38.2	41	84	40.8	
ANTIMONY	MG/KG	0.98 N	1.1 N		UG/L	1.1 B	6.1 B		MG/KG	0.1 B	0.13 B	0.07 U	0.07 U	0.1 B	0.15 B	0.11 B	0.11 B	0.08 B	0.19 B	
ARSENIC	MG/KG	16.6	12.5		UG/L	3.2 J	33.2		MG/KG	1.8 B	1.5 B	1.7 B	0.53 U	1.8 B	2.6 B	2.4 B	2.2 B	2.4 B	2.6 B	
BERYLLIUM	MG/KG	2.3 E	2.1 E		UG/L	0.1 U	0.53 J		MG/KG	0.03 B	0.03 B	0.03 B	0.03 B	0.03 B	0.03 B	0.04 B	0.03 B	0.04 B	0.04 B	
CADMIUM	MG/KG	0.34 B	0.34 B		UG/L	0.2 UJ	0.2 U		MG/KG	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	
CHROMIUM	MG/KG	28.5	29.9		UG/L	0.7 U	4.4 B		MG/KG	0.35 B	0.69 B	0.48 B	0.12 U	0.57 B	0.41 B	0.38 B	0.45 B	0.52 B	0.39 B	
COPPER	MG/KG	59.3	50.4		UG/L	1.2 B	2.9 B		MG/KG	1.6	1.4	1.5	0.6 B	1.8	2.3	2.1	2.3	2.3	1.7	
IRON	MG/KG	39100	37300		UG/L	7.3 B	5.5 U		MG/KG	70.4	61.7	64	24.9 B	66.3	156	153				

TOLCHESTER STRAIGHTENING (CONTINUED)

ANALYTE	Sediment Units	MATRIX: SEDIMENT			ELUTRIATE		NEREIS VIRENS TISSUE					MACOMA NASUTA TISSUE							
		TLS1VC	TLS2VC	TLSVCCOMP	Elutriate Units	TLSVC-EL Sept-1999	TLSVC-EL Dec-1999	Tissue Units	TLS-A	TLS-B	TLS-C	TLS-D	TLS-E	TLS-A	TLS-B	TLS-C	TLS-D	TLS-E	
PAHs																			
ACENAPHTHENE	UG/KG	290 P	240 P		UG/L	0.39 U	0.39 U	UG/KG	5.6 U	5.6 U	5.6 U	5.6 U	5.6 U	5.6 U	5.6 U	5.6 U	5.6 U		
ACENAPHTHYLENE	UG/KG	260	180		UG/L	0.38 U	0.38 U	UG/KG	84 U	42 U	42 U	42 U	42 U	750	560	510	360	550	
ANTHRACENE	UG/KG	160	150		UG/L	0.03 U	0.03 U	UG/KG	1.1 U	1.1 U	1.1 U	1.1 U	1.1 U	3.9 J	4.3	3.9 J	4	4.4 J	
BENZ[A]ANTHRACENE	UG/KG	97	84		UG/L	0.03 U	0.03 U	UG/KG	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U	3.6 J	4.3 J	3.2 J	3.8 J	3.8 J	
BENZO[A]PYRENE	UG/KG	120	100		UG/L	0.04 U	0.04 U	UG/KG	0.82 U	0.82 U	0.82 U	0.82 U	0.82 U	1.1 J	1.4 J	0.82 U	1.3 J	1.3 J	
BENZO[B]FLUORANTHENE	UG/KG	220 P	240 P		UG/L	0.03 U	0.03 U	UG/KG	1.6 U	1.6 U	1.6 U	1.6 U	1.6 U	16 J	18	13 J	21	14	
BENZO[G,H,I]PERYLENE	UG/KG	73	65		UG/L	0.06 U	0.06 U	UG/KG	1.8 U	1.8 U	1.8 U	1.8 U	1.8 U	1.8 U	1.8 U	1.8 U	1.8 U	1.8 U	
BENZO[K]FLUORANTHENE	UG/KG	53	50		UG/L	0.05 U	0.05 U	UG/KG	0.88 U	0.88 U	0.88 U	0.88 U	0.88 U	0.88 U	0.93 J	0.88 U	0.89 J	0.88 U	
CHRYSENE	UG/KG	79	68		UG/L	0.02 U	0.02 U	UG/KG	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	4.4 J	5.3	3.8	4.9 J	4.8	
DIBENZ[A,H]ANTHRACENE	UG/KG	6.7 P	8.4		UG/L	0.06 U	0.06 U	UG/KG	1.8 U	1.8 U	1.8 U	1.8 U	1.8 U	1.8 U	1.8 U	1.8 U	1.8 U	1.8 U	
FLUORANTHENE	UG/KG	400 PD	390 P		UG/L	0.04 U	0.04 U	UG/KG	1.6 U	1.6 U	1.6 U	1.6 U	1.6 U	9.6 J	11	9.1 JJ	10 J	9 J	
FLUORENE	UG/KG	190 P	160 P		UG/L	0.06 U	0.06 U	UG/KG	2 U	2 U	2 U	2 U	2 U	17 J	18 J	14 J	19	22	
INDENO[1,2,3-CD]PYRENE	UG/KG	50 D	45 D		UG/L	0.03 U	0.03 U	UG/KG	1.6 U	1.6 U	1.6 U	1.6 U	1.6 U	1.6 U	1.6 U	1.6 U	1.6 U	1.6 U	
NAPHTHALENE	UG/KG	710	540		UG/L	0.32 U	0.32 U	UG/KG	7.2 U	7.2 U	7.2 U	7.2 U	7.2 U	48	54 J	68 J	35	38 J	
PHENANTHRENE	UG/KG	460 D	430 D		UG/L	0.03 U	0.03 U	UG/KG	2 U	2 U	2 U	2 U	2 U	4.1 J	5.5 J	3	5.1 J	5.5	
PYRENE	UG/KG	330 D	340 D		UG/L	0.06 U	0.06 U	UG/KG	0.88 U	0.88 U	0.88 U	0.88 U	0.88 U	0.92 J	5 J	6 J	3.9 J	6.6 J	5.6 J
TOTAL PAH (ND=0)	UG/KG	3498.7	3090.4		UG/L	0	0	UG/KG	0	0	0	0	0	863	689	632	472	658	
TOTAL PAH (ND=1/2)	UG/KG	3498.7	3090.4		UG/L	0.82	0.82	UG/KG	57.4	36.4	36.4	36.4	36.9	869	694	638	477	664	
TOTAL PAH (ND=DL)	UG/KG	3498.7	3090.4		UG/L	1.63	1.63	UG/KG	115	72.9	72.9	72.9	72.9	874	700	644	482	670	
PCB AROCLORS																			
AROCLOR 1016	UG/KG	5.7 U	6.6 U		UG/L	0.33 U	0.33 U	UG/KG	15 U		15 U	15 U	15 U	15 U	15 U	15 U	15 U	15 U	
AROCLOR 1221	UG/KG	7.2 U	8.3 U		UG/L	0.32 U	0.32 U	UG/KG	3.8 U		3.8 U	3.8 U	3.8 U	3.8 U	3.8 U	3.8 U	3.8 U	3.8 U	
AROCLOR 1232	UG/KG	13 U	15 U		UG/L	0.29 U	0.29 U	UG/KG	10 U		10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	
AROCLOR 1242	UG/KG	9.4 U	11 U		UG/L	0.3 U	0.3 U	UG/KG	4.9 U		4.9 U	4.9 U	4.9 U	4.9 U	4.9 U	4.9 U	4.9 U	4.9 U	
AROCLOR 1248	UG/KG	2.8 U	3.2 U		UG/L	0.09 U	0.09 U	UG/KG	8.7 U		8.7 U	8.7 U	8.7 U	8.7 U	8.7 U	8.7 U	8.7 U	8.7 U	
AROCLOR 1254	UG/KG	8.3 U	9.5 U		UG/L	0.44 U	0.44 U	UG/KG	7.2 U		7.2 U	7.2 U	7.2 U	7.2 U	7.2 U	7.2 U	7.2 U	7.2 U	
AROCLOR 1260	UG/KG	5.2 U	6 U		UG/L	0.41 UJ	0.41 U	UG/KG	14 U		14 U	14 U	14 U	14 U	14 U	14 U	14 U	14 U	
PCB CONGENERS																			
BZ# 8*	UG/KG	0.24	0.35		UG/L	0.003 U	0.0031 J	UG/KG	0.24 U		0.24 U	0.24 U	0.24 U	0.24 U	0.24 U	0.24 U	0.24 U	0.24 U	
BZ# 18*	UG/KG	0.21 P	0.31 P		UG/L	0.0064 U	0.01 J	UG/KG	0.12 U		0.12 U	0.12 U	0.12 U	0.12 U	0.12 U	0.12 U	0.12 U	0.12 U	
BZ# 28*	UG/KG	0.24 P	0.28		UG/L	0.0065 U	0.0065 U	UG/KG	0.12 U		0.12 U	0.12 U	0.12 U	0.12 U	0.12 U	0.12 U	0.12 U	0.12 U	
BZ# 44*	UG/KG	0.16 P	0.26 P		UG/L	0.0055 U	0.0055 U	UG/KG	0.11 U		0.11 U	0.11 U	0.11 U	0.11 U	0.11 U	0.11 U	0.11 U	0.11 U	
BZ# 49	UG/KG	0.18 U	0.29		UG/L	0.003 U	0.003 U	UG/KG	0.26 U		0.26 U	0.26 U	0.26 U	0.26 U	0.26 U	0.26 U	0.26 U	0.26 U	
BZ# 52*	UG/KG	0.11 U	0.2 P		UG/L	0.0022 U	0.0022 U	UG/KG	0.14 U		0.14 U	0.14 U	0.14 U	1 J	0.14 U	0.14 U	0.14 U	0.14 U	
BZ# 66*	UG/KG	0.22 P	0.35 P		UG/L	0.0004 U	0.0004 U	UG/KG	0.33 U		0.33 U	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U	0.33 U	
BZ# 77*	UG/KG	0.32 P	1.2		UG/L	0.0025 U	0.0025 U	UG/KG	0.21 U		0.81 J	0.21 U	0.21 U	0.21 U	0.21 U	0.21 U	0.21 U	0.21 U	
BZ# 87	UG/KG	0.06 P	0.17 P		UG/L	0.0012 U	0.0012 U	UG/KG	0.13 U		0.13 U	0.13 U	0.13 U	0.13 U	0.13 U	0.13 U	0.13 U	0.13 U	
BZ# 101*	UG/KG	0.19 P	0.89		UG/L	0.0													

TOLCHESTER STRAIGHTENING (CONTINUED)

ANALYTE	Sediment Units	MATRIX: SEDIMENT			ELUTRIATE		NEREIS VIRENS TISSUE					MACOMA NASUTA TISSUE						
		TLS1VC	TLS2VC	TLSVCCOMP	Elutriate Units	TLSVC-EL Sept-1999	TLSVC-EL Dec-1999	Tissue Units	TLS-A	TLS-B	TLS-C	TLS-D	TLS-E	TLS-A	TLS-B	TLS-C	TLS-D	TLS-E
PESTICIDES (continued)																		
4,4'-DDT	UG/KG	0.7 U	0.8 U		UG/L	0.02 UJ	0.02 U	UG/KG	1.2 UJ		1.2 U	1.2 U	1.2 U	1.2 U	1.2 U	1.2 U	1.2 U	1.2 UJ
ALDRIN	UG/KG	0.55 U	0.63 U		UG/L	0.02 U	0.02 U	UG/KG	0.53 UJ		0.53 U	0.53 U	0.53 U	0.53 U	0.53 U	0.53 U	0.53 U	1.9 J
ALPHA-BHC	UG/KG	0.4 U	0.46 U		UG/L	0.01 U	0.01 U	UG/KG	0.72 U		0.72 U	0.72 U	0.72 U	0.72 U	0.72 U	0.72 U	0.72 U	0.72 U
BETA-BHC	UG/KG	0.52 U	0.6 U		UG/L	0.01 U	0.02 J	UG/KG	0.77 U		0.77 U	0.77 U	7.4 J	0.77 U	0.77 U	0.77 U	0.77 U	0.77 U
CHLORBENZIDE	UG/KG	3.5 U	4.1 U		UG/L	0.1 UJ	0.1 U	UG/KG	23 J		12 J	14 J	4.6 J	3.3 U	3.3 U	3.3 U	3.3 U	3.3 U
CHLORDANE	UG/KG	1.7 U	2 U		UG/L	0.1 U	0.1 U	UG/KG	3.3 U		3.3 U	3.3 U	3.3 U	3.3 U	3.3 U	3.3 U	3.3 U	3.3 U
DACTHAL	UG/KG	3.5 U	4.1 U		UG/L	0.1 U	0.1 U	UG/KG	51		50	51	50	3.3 U	3.3 U	3.3 U	3.3 U	3.3 U
DELTA-BHC	UG/KG	0.52 U	0.6 U		UG/L	0.01 U	0.01 U	UG/KG	0.69 U		0.69 U	0.69 U	0.69 U	0.69 U	0.69 U	0.69 U	0.69 U	0.69 U
DIELDRIN	UG/KG	0.46 U	0.52 U		UG/L	0.01 U	0.01 U	UG/KG	0.77 U		0.77 U	1.1	0.77 U	1.3 J	1.3	1.6	0.77 U	1.4 J
ENDOSULFAN I	UG/KG	0.77 U	0.88 U		UG/L	0.01 U	0.01 U	UG/KG	0.61 U		0.61 U	0.61 U	0.61 U	0.61 U	0.61 U	0.61 U	0.61 U	0.61 U
ENDOSULFAN II	UG/KG	0.38 U	0.44 U		UG/L	0.02 U	0.02 U	UG/KG	10 J		7.3 J	0.86 U	8.2 J	0.86 U	0.86 U	0.86 U	0.86 U	0.86 U
ENDOSULFAN SULFATE	UG/KG	0.89 U	1 U		UG/L	0.02 UJ	0.02 U	UG/KG	0.95 U		0.95 U	0.95 U	0.95 U	0.95 U	0.95 U	0.95 U	0.95 U	0.95 U
ENDRIN	UG/KG	1.6 U	1.8 U		UG/L	0.03 U	0.03 U	UG/KG	0.98 UJ		0.98 UJ	0.98 UJ	0.98 UJ	0.98 U	0.98 U	0.98 U	0.98 U	0.98 UJ
ENDRIN ALDEHYDE	UG/KG	1 U	1.1 U		UG/L	0.03 UJ	0.03 U	UG/KG	1.2 U		1.2 U	1.2 U	1.2 U	1.2 U	1.6 J	1.2 U	1.2 U	1.2 U
GAMMA-BHC	UG/KG	0.48 U	0.55 U		UG/L	0.0081 U	0.02	UG/KG	0.82 UJ		0.82 U	0.82 U	0.82 U	1.1 J	0.82 U	0.82 U	0.82 U	0.82 U
HEPTACHLOR	UG/KG	0.64 U	0.73 U		UG/L	0.02 UJ	0.03	UG/KG	0.68 U		0.68 U	0.68 U	0.68 U	0.68 U	2.6	0.68 U	0.68 U	0.68 U
HEPTACHLOR EPOXIDE	UG/KG	1.6 P	0.99 U		UG/L	0.01 UJ	0.03 J	UG/KG	0.73 U		1.3 J	1.1 J	3.5	0.73 U	0.73 U	0.95 J	0.77 J	0.73 U
METHOXYCHLOR	UG/KG	2.8 U	3.2 U		UG/L	0.08 UJ	0.08 U	UG/KG	3 U		3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U
MIREX	UG/KG	3.5 U	4.1 U		UG/L	0.1 U	0.1 U	UG/KG	3.3 U		3.3 U	3.3 U	3.3 U	3.3 U	3.3 U	3.3 U	3.3 U	3.3 U
TOXAPHENE	UG/KG	15 U	17 U		UG/L	0.49 U	0.49 U	UG/KG	13 U		13 U	13 U	13 U	13 U	13 U	13 U	13 U	13 U
ORGANOPHOSPHORUS PESTICIDES																		
AZINPHOS METHYL	UG/KG	23 U	27 U		UG/L	0.58 U	0.58 U											
DEMETON	UG/KG	22 U	26 U		UG/L	2 U	2 U											
ETHYL PARATHION	UG/KG	35 U	40 U		UG/L	1 U	1 U											
MALATHION	UG/KG	17 U	19 U		UG/L	0.22 U	0.22 U											
METHYL PARATHION	UG/KG	18 U	21 U		UG/L	0.24 U	0.24 U											
ORGANOTINS																		
MONOBUTYLtin	UG/KG	2 U	2.2 U		UG/L	32 U	34 U											
DIBUTYLtin	UG/KG	7	2.8 U		UG/L	40 U	43 U											
TRIBUTYLtin	UG/KG	3 U	3.3 U		UG/L	46 U	49 U											
TETRABUTYLYtin	UG/KG	3.4 U	3.7 U		UG/L	52 U	56 U											
SVOCs																		
1,2,4-TRICHLOROBENZENE	UG/KG	79 U	91 U		UG/L	2 U	2.2 U	UG/KG	130 U	130 U	130 U	130 U	130 U	120 U	120 U	120 U	120 U	120 U
1,2-DICHLOROBENZENE	UG/KG	57 U	66 U		UG/L	2 U	2.2 U	UG/KG	150 U	150 U	150 U	150 U	150 U	140 U	140 U	140 U	140 U	140 U
1,2-DIPHENYLHYDRAZINE	UG/KG	58 U	67 U		UG/L	3 U	3.2 U	UG/KG	71 U	71 U	71 U	71 U	71 U	70 U	70 U	70 U	70 U	70 U
1,4-DICHLOROBENZENE	UG/KG	77 U	89 U		UG/L	2 U	2.2 U	UG/KG	150 U	150 U	150 U	150 U	150 U	140 U	140 U	140 U	140 U	140 U
1-METHYLNAPHTHALENE	UG/KG	230	190		UG/L	0.31 U	0.31 U	UG/KG	9.6 U	9.6 U	17 J	9.6 U	9.6 U	18 J	19 J	19 J	9.6 U	19 J
2,2'-OXYBIS(1-CHLOROPROPANE)	UG/KG	88 U	100 U		UG/L	1 U	1.1 U	UG/KG	160 U	160 U	160 U	160 U	160 U	150 U	150 U	150 U	150 U	150 U
2,4,6-TRICHLOROPHENOL	UG/KG	81 U	94 U		UG/L	2 U	2.2 U	UG/KG	86 U	86 U	86 U	86 U	86 U	84 U	84 U	84 U	84 U	84 U
2,4-DICHLOROPHENOL	UG/KG	72 U	83 U		UG/L	2 U	2.2 U	UG/KG	100 U	100 U	100 U	100 U	100 U	100 U	100 U	100 U	100 U	100 U
2,4-DIMETHYLPHENOL	UG/KG	140 U	160 U		UG/L	4 U	4.3 U	UG/KG	87 U	87 U	87 U	87 U	87 U	85 U	85 U	85 U	85 U	85 U
2,4-DINITROPHENOL	UG/KG	670 U	770 U		UG/L	23 U	25 U	UG/KG	200 U	200 U	200 U	200 U	200 U	190 U	190 U	190 U	190 U	190 U
2,4-DINITROTOLUENE	UG/KG	54 U																

TOLCHESTER STRAIGHTENING (CONTINUED)

**TOLCHESTER STRAIGHTENING (1999): CONCENTRATIONS OF
DETECTED ANALYTES IN BULK SEDIMENT THAT EXCEED TELs**

ANALYTE	UNIT	TEL* VALUE	TLS1VC	TLS2VC
METALS				
ARSENIC	MG/KG	7.24	16.6	12.5
CADMIUM	MG/KG	0.676		
CHROMIUM	MG/KG	52.3		
COPPER	MG/KG	18.7	59.3	50.4
LEAD	MG/KG	30.24	48	48.9
MERCURY	MG/KG	0.13	0.65	0.31B
NICKEL	MG/KG	15.9	59.7	60.2
SILVER	MG/KG	0.73		
ZINC	MG/KG	124	229E	247E
PAHs				
ACENAPHTHENE	UG/KG	6.71	290P	240P
ACENAPHTHYLENE	UG/KG	5.87	260	180
ANTHRACENE	UG/KG	46.85	160	150
BENZ[A]ANTHRACENE	UG/KG	74.83	97	84
BENZO[A]PYRENE	UG/KG	88.81	120	100
CHRYSENE	UG/KG	107.77		
DIBENZ[A,H]ANTHRACENE	UG/KG	6.22	6.7P	8.4
FLUORANTHENE	UG/KG	112.82	400P	390P
FLUORENE	UG/KG	21.17	190P	160P
NAPHTHALENE	UG/KG	34.57	710	540
PHENANTHRENE	UG/KG	86.68	460	430
PYRENE	UG/KG	152.66	330	340
TOTAL PAH (ND=DL)	UG/KG	1684.06	3498.7	3090.4
PESTICIDES				
4,4'-DDD	UG/KG	1.22		
4,4'-DDE	UG/KG	2.07		
4,4'-DDT	UG/KG	1.19		
CHLORDANE	UG/KG	2.26		
DIELDRIN	UG/KG	0.715		
GAMMA-BHC	UG/KG	0.32	0.48U	0.55U
PCBs				
TOTAL PCB (ND=DL)	UG/KG	21.55		
SVOCs				
2-METHYLNAPHTHALENE	UG/KG	20.21	510	470
BIS(2-ETHYLHEXYL) PHTHALATE	UG/KG	182.16		

**TOLCHESTER STRAIGHTENING (1999): CONCENTRATIONS OF
DETECTED ANALYTES IN BULK SEDIMENT THAT EXCEED PELs**

ANALYTE	UNIT	PEL* VALUE	TLS1VC	TLS2VC
METALS				
ARSENIC	MG/KG	41.6		
CADMIUM	MG/KG	4.21		
CHROMIUM	MG/KG	160.4		
COPPER	MG/KG	108.2		
LEAD	MG/KG	112.18		
MERCURY	MG/KG	0.696		
NICKEL	MG/KG	42.8	59.7	60.2
SILVER	MG/KG	1.7		
ZINC	MG/KG	271		
PAHs				
ACENAPHTHENE	UG/KG	88.9	290P	240P
ACENAPHTHYLENE	UG/KG	127.87	160	180
ANTHRACENE	UG/KG	245		
BENZ[A]ANTHRACENE	UG/KG	692.53		
BENZO[A]PYRENE	UG/KG	763.22		
CHRYSENE	UG/KG	845.98		
DIBENZ[A,H]ANTHRACENE	UG/KG	134.61		
FLUORANTHENE	UG/KG	1493.54		
FLUORENE	UG/KG	144.35	190P	160P
NAPHTHALENE	UG/KG	390.64	710	540
PHENANTHRENE	UG/KG	543.53		
PYRENE	UG/KG	1397.6		
TOTAL PAHs (ND=DL)	UG/KG	16770.4		
PESTICIDES				
4,4'-DDD	UG/KG	7.81		
4,4'-DDE	UG/KG	374.17		
4,4'-DDT	UG/KG	4.77		
CHLORDANE	UG/KG	4.79		
DIELDRIN	UG/KG	4.3		
GAMMA-BHC	UG/KG	0.99		
PCBs				
TOTAL PCB (ND=DL)	UG/KG	188.79		
SVOCs				
2-METHYLNAPHTHALENE	UG/KG	201.28	510	470
BIS(2-ETHYLHEXYL) PHTHALATE	UG/KG	2646.51		

APPLICABLE FEDERAL WATER QUALITY CRITERIA

Analyte	Units	EPA SALTWATER CRITERIA		
		ACUTE ^a	CHRONIC ^b	HUMAN HEALTH ^c
NON-METALS				
NITROGEN, AMMONIA	MG/L	52 ^s	7.8 ^s	
VOCs				
DICHLOROMETHANE	UG/L			16000 ^y
SVOCs				
BIS(2-ETHYLHEXYL) PHTHALATE	UG/L			59 ^y
PESTICIDES				
BETA-BHC	UG/L			0.46 ^y
GAMMA-BHC	UG/L	0.16		0.63 ^y
HEPTACHLOR	UG/L	0.053	0.0036	0.0021 ^y
HEPTACHLOR EPOXIDE	UG/L	0.053	0.0036	0.0011 ^y
PCBs				
TOTAL PCB	UG/L			0.0017 ^{fy}
METALS				
ANTIMONY	UG/L			4300
ARSENIC	UG/L	69 ^g	36 ^g	0.14 ^h
BERYLLIUM	UG/L			0.117 ^j
CHROMIUM	UG/L	1100 ^k	50 ^k	
COPPER	UG/L	4.8 ^l	3.1 ^l	
LEAD	UG/L	210 ^o	8.1 ^o	
MANGANESE	UG/L			100
NICKEL	UG/L	74 ^r	8.2 ^r	4600
SELENIUM	UG/L	290 ^t	71 ^t	
SILVER	UG/L	1.9 ^u		

Source: USEPA's *National Recommended Water Quality Criteria* [63 Federal Register 68354-68364]

Superscripts:

a = acute aquatic life criteria based on 1-hr average exposure concentrations.

b = chronic aquatic life criteria based on 4-day average exposure concentrations.

c = EPA human health criteria based on daily lifetime (70-year) average consumption of aquatic organisms; criteria based on 10^{-5} risk for carcinogens.

f = applies to Total PCBs (sum of all congeners or isomer analyses).

g = total dissolved arsenic.

h = inorganic arsenic only.

j = from EPA 1986 Gold Book; no EPA 1998 number.

k = dissolved chromium; hexavalent.

l = dissolved copper.

o = dissolved lead.

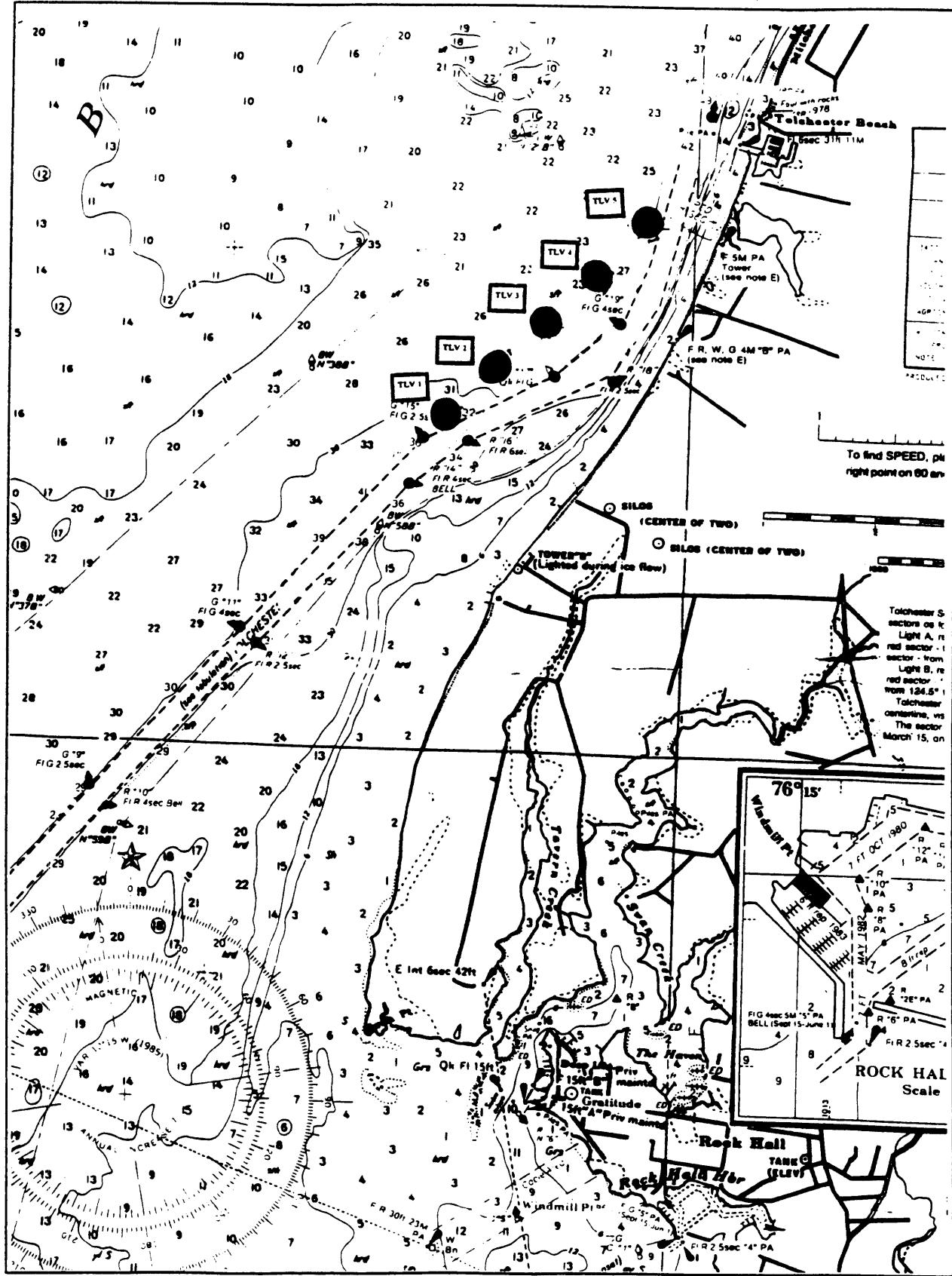
r = dissolved nickel.

s = total ammonia; assumes cold weather conditions: salinity = 10 ppt, water temperature = 10 C, and pH=7.4

t = dissolved selenium.

u = dissolved silver.

y = carcinogen



Gravity coring locations in Tolchester straightening – 1995

TOLCHESTER STRAIGHTENING SEDIMENT AND ELUTRIATE CHEMISTRY - 1995

ANALYTE	UNITS	SEDIMENT					ELUTRIATE	
		station ID	TLV1	TLV2	TLV3	TLV4		
	core depth (ft)	4.2 ft	3.8 ft	3.4 ft	3.1 ft	3.9 ft	UNITS	TLVEL
INORGANIC NON-METALS								
CYANIDE	MG/KG	0.47	0.41U	0.4U	0.41U	0.4U	MG/L	0.01U
MOISTURE CONTENT	%	55.3	52.7	53.3	55.8	56.2		NA
NITROGEN, AMMONIA	MG/KG	134	114	75.9	71.6	205	MG/L	3.7
NITROGEN, NITRATE AND NITRITE	MG/KG	2.5	2	3.8	3.1	3.3	MG/L	0.35
NITROGEN, TOTAL KJELDAHL	MG/KG	444	1030	721	854	1030	MG/L	3.9
OXYGEN DEMAND, BIOCHEMICAL	MG/KG	671	977	1210	976	914	MG/L	2.6
OXYGEN DEMAND, CHEMICAL	MG/KG	63000	78900	56400	66900	67500	MG/L	238
PHOSPHORUS, TOTAL	MG/KG	985	1050	983	1370	1210	MG/L	0.05U
SPECIFIC GRAVITY	T/4C	1.12	1.44	1.09	1.16	1.13		NA
SULFIDE, TOTAL	MG/KG	2270	581	41U	183	48.8U	MG/L	1U
TOTAL ORGANIC CARBON	MG/KG	54800	75300	64500	55200	47400	MG/L	22.5
GRAIN SIZE DISTRIBUTION								
CLAY	%	53	55.3	59.2	58.4	49.4		NA
GRAVEL	%	0	0	0	0	0		NA
SAND	%	1.2	1.3	1.2	1.1	10.5		NA
SILT	%	45.8	43.4	39.6	40.5	40.1		NA
SILT-CLAY	%	98.8	98.7	98.8	98.9	89.5		NA
METALS								
ALUMINUM	MG/KG	18500	18700	17700	21300	20000	UG/L	165B
ANTIMONY	MG/KG	0.19UN	0.19UN	0.19BN	0.26BN	0.23BN	UG/L	5.4B
ARSENIC	MG/KG	14.3	15.1	12.7	16.5	13.1	UG/L	5.7B
BERYLLIUM	MG/KG	2.4	2.2	2	2.4	2	UG/L	1UN
CADMIUM	MG/KG	1.6	1.5	1.7	2	2	UG/L	1UN
CHROMIUM	MG/KG	39.1	35.2	36.6	42.1	38.4	UG/L	1.3BW
COPPER	MG/KG	59	56.2	49.6	60.3	47.8	UG/L	2.9BW
IRON	MG/KG	37500	37200	35400	41900	42200	UG/L	390N
LEAD	MG/KG	58.3	55.8	51.5	66.3	55.9	UG/L	1UN
MANGANESE	MG/KG	2430	2060	2130	2320	2660	UG/L	1270N
MERCURY	MG/KG	0.58	0.53	0.42	0.56	0.44	UG/L	0.1U
NICKEL	MG/KG	72.2	70.9	66.5	75.6	64.1	UG/L	18.6BNS
SELENIUM	MG/KG	2.4	1.6	1.2	3*	2.2*	UG/L	2U
SILVER	MG/KG	0.57U	0.57U	0.5U	0.62U	0.63U	UG/L	4U
THALLIUM	MG/KG	0.4U	0.38U	0.33U	0.43UNW	0.38UN	UG/L	2UNW
ZINC	MG/KG	316	318	307	365N	294N	UG/L	64N
ORGANOPHOSPHORUS PESTICIDES								
AZINPHOS METHYL	UG/KG	14U	13U	13U	15U	14U	UG/L	2U
DEMETON	UG/KG	14U	13U	13U	15U	14U	UG/L	2U
ETHYL PARATHION	UG/KG	1.3U	1.3U	1.3U	1.5U	1.4U	UG/L	0.2U
MALATHION	UG/KG	1.3U	1.3U	1.3U	1.5U	1.4U	UG/L	0.2U
METHYL PARATHION	UG/KG	1.3U	1.3U	1.3U	1.5U	1.4U	UG/L	0.2U
PAHs								
ACENAPHTHENE	UG/KG	51	40	60	180	61	UG/L	3U
ACENAPHTHYLENE	UG/KG	48U	46U	48U	53U	52U	UG/L	3U
ANTHRACENE	UG/KG	19	7.6	10	42	12	UG/L	2U
BENZ[A]ANTHRACENE	UG/KG	19	14	24	44	20	UG/L	1U
BENZO[A]PYRENE	UG/KG	31	19	34	57	28	UG/L	1U
BENZO[B]FLUORANTHENE	UG/KG	43	22	43	120	87	UG/L	1U
BENZO[G,H,I]PERYLENE	UG/KG	14	10	20	46	22	UG/L	1U
BENZO[K]FLUORANTHENE	UG/KG	13	7.4	13	24	11	UG/L	2U
CHRYSENE	UG/KG	22	16	28	56	27	UG/L	2U
DIBENZ[A,H]ANTHRACENE	UG/KG	2.8	1.9U	2.8	5.7	2.5	UG/L	2U
FLUORANTHENE	UG/KG	36	28	47	120	55	UG/L	2U
FLUORENE	UG/KG	260	140	130	1100	150	UG/L	2U
INDENO[1,2,3-CD]PYRENE	UG/KG	23	12	23	41	22	UG/L	1U
NAPHTHALENE	UG/KG	89	99	120	650	75	UG/L	5U
PHENANTHRENE	UG/KG	41	25	32	160	48	UG/L	2U
PYRENE	UG/KG	15	21	33	110	49	UG/L	1U
TOTAL PAH (ND=DL)	UG/KG	726.8	508.9	667.8	2808.7	721.5	UG/L	31
TOTAL PAHS (ND=1/2)	UG/KG	702.8	484.95	643.8	2782.2	695.5	UG/L	15.5

TOLCHESTER STRAIGHTENING SEDIMENT AND ELUTRIATE CHEMISTRY - 1995

ANALYTE	UNITS	SEDIMENT					ELUTRIATE	
		station ID core depth (ft)	TLV1 4.2 ft	TLV2 3.8 ft	TLV3 3.4 ft	TLV4 3.1 ft	TLV5 3.9 ft	
PCB AROCLORS								
AROCLOR 1016	UG/KG		8.1U	7.6U	7.9U	8.9U	8.7U	UG/L 0.07U
AROCLOR 1221	UG/KG		20U	19U	20U	22U	22U	UG/L 1.1U
AROCLOR 1232	UG/KG		6.1U	5.7U	6U	6.7U	6.5U	UG/L 0.3U
AROCLOR 1242	UG/KG		8.1U	7.6U	7.9U	8.9U	8.7U	UG/L 0.4U
AROCLOR 1248	UG/KG		2U	1.9U	2U	2.2U	2.2U	UG/L 0.24U
AROCLOR 1254	UG/KG		4U	3.8U	4U	4.5U	4.3U	UG/L 0.46U
AROCLOR 1260	UG/KG		2U	1.9U	2U	2.2U	2.2U	UG/L 0.06U
CHLORINATED PESTICIDES								
4,4'-DDD	UG/KG		2.9U	2.7U	2.8U	3.1U	3U	UG/L 0.03U
4,4'-DDE	UG/KG		0.59U	0.56U	0.58U	0.64U	0.63U	UG/L 0.01U
4,4'-DDT	UG/KG		3.3U	3.1U	3.2U	3.6U	3.5U	UG/L 0.02U
ALDRIN	UG/KG		0.33U	0.31U	0.32U	0.36U	0.35U	UG/L 0.007U
ALPHA-BHC	UG/KG		2.2U	2.1U	2.2U	2.4U	2.4U	UG/L 0.006U
BETA-BHC	UG/KG		0.2U	0.19U	0.2U	0.22U	0.22U	UG/L 0.003U
CHLORBENZIDE	UG/KG		1.3U	1.3U	1.3U	1.5U	1.4U	UG/L 0.2U
CHLORDANE	UG/KG		7.6U	7.1U	7.4U	8.2U	8U	UG/L 0.11U
DACTHAL	UG/KG		1.3U	1.3U	1.3U	1.5U	1.4U	UG/L 0.2U
DELTA-BHC	UG/KG		0.35U	0.33U	0.34U	0.38U	0.37U	UG/L 0.003U
DIELDRIN	UG/KG		2.7U	2.5U	2.6U	2.9U	2.8U	UG/L 0.03U
ENDOSULFAN I	UG/KG		0.2U	0.19U	0.2U	0.22U	0.22U	UG/L 0.009U
ENDOSULFAN II	UG/KG		0.47U	0.44U	0.46U	0.51U	0.5U	UG/L 0.007U
ENDOSULFAN SULFATE	UG/KG		1U	0.98U	1U	1.1U	1.1U	UG/L 0.01U
ENDRIN	UG/KG		2.9U	2.7U	2.8U	3.1U	3U	UG/L 0.03U
ENDRIN ALDEHYDE	UG/KG		0.2U	0.19U	0.2U	0.22U	0.22U	UG/L 0.01U
GAMMA-BHC	UG/KG		1.5U	1.4U	1.5U	1.6U	1.6U	UG/L 0.01U
HEPTACHLOR	UG/KG		1.7U	1.6U	1.7U	1.8U	1.8U	UG/L 0.01U
HEPTACHLOR EPOXIDE	UG/KG		0.2U	0.19U	0.2U	1.2P	0.22U	UG/L 0.004U
METHOXYCHLOR	UG/KG		24U	23U	24U	27U	26U	UG/L 0.24U
MIREX	UG/KG		1.3U	1.3U	1.3U	1.5U	1.4U	UG/L 0.2U
TOXAPHENE	UG/KG		110U	100U	110U	120U	120U	UG/L 0.62U
BUTYLTINS								
MONOBUTYLTIN	UG/KG		NT	NT	0.3U	NT	NT	NT
DIBUTYLTIN	UG/KG		NT	NT	0.3U	NT	NT	NT
TRIBUTYLTIN	UG/KG		NT	NT	0.3U	NT	NT	NT
VOLATILE ORGANIC COMPOUNDS (VOCs)								
1,1,1-TRICHLOROETHANE	UG/KG		0.6U	0.6U	0.6U	0.7U	0.7U	UG/L 1U
1,1,2,2-TETRACHLOROETHANE	UG/KG		0.8U	0.8U	0.8U	0.9U	0.9U	UG/L 1U
1,1,2-TRICHLOROETHANE	UG/KG		1U	1U	1U	1U	1U	UG/L 1U
1,1-DICHLOROETHANE	UG/KG		0.8U	0.8U	0.8U	0.9U	0.9U	UG/L 1U
1,1-DICHLOROETHYLENE	UG/KG		0.8U	0.8U	0.8U	0.9U	0.9U	UG/L 1U
1,2-DICHLOROETHANE	UG/KG		1U	1U	1U	1U	1U	UG/L 1U
1,2-DICHLOROPROPANE	UG/KG		1U	1U	1U	2U	2U	UG/L 1U
2-BUTANONE	UG/KG		2U	2U	2U	2U	2U	UG/L 1U
2-CHLOROETHYL VINYL ETHER	UG/KG		1U	1U	1U	1U	1U	UG/L 1U
ACROLEIN	UG/KG		10U	9U	9U	10U	10U	UG/L 8U
ACRYLONITRILE	UG/KG		6U	6U	6U	7U	7U	UG/L 5U
BENZENE	UG/KG		0.8U	0.8U	0.8U	0.9U	0.9U	UG/L 1U
BROMODICHLOROMETHANE	UG/KG		1U	1U	1U	1U	1U	UG/L 1U
BROMOMETHANE	UG/KG		1U	1U	1U	1U	1U	UG/L 1U
CARBON TETRACHLORIDE	UG/KG		0.6U	0.6U	0.6U	0.7U	0.7U	UG/L 1U
CHLOROBENZENE	UG/KG		0.6U	0.6U	0.6U	0.7U	0.7U	UG/L 1U
CHLORODIBROMOMETHANE	UG/KG		1U	1U	1U	1U	1U	UG/L 1U
CHLOROETHANE	UG/KG		2U	2U	2U	2U	2U	UG/L 1U
CHLOROFORM	UG/KG		0.8U	0.8U	0.8U	0.9U	0.9U	UG/L 1U
CHLOROMETHANE	UG/KG		2U	2U	2U	2U	2U	UG/L 2U
CIS-1,3-DICHLOROPROPENE	UG/KG		0.6U	0.6U	0.6U	0.7U	0.7U	UG/L 1U
DICHLORODIFLUOROMETHANE	UG/KG		1U	1U	1U	1U	1U	UG/L 1U
DICHLOROMETHANE	UG/KG		1U	1U	1U	2U	2U	UG/L 3
ETHYLBENZENE	UG/KG		1U	1U	1U	1U	1U	UG/L 1U
METHYLBENZENE	UG/KG		0.6U	0.6U	0.6U	0.7U	0.7U	UG/L 1U
TETRACHLOROETHENE	UG/KG		1U	1U	1U	1U	1U	UG/L 1U
TRANS-1,2-DICHLOROETHENE	UG/KG		1U	1U	1U	1U	1U	UG/L 1U
TRANS-1,3-DICHLOROPROPENE	UG/KG		1U	1U	1U	1U	1U	UG/L 1U
TRIBOMOMETHANE	UG/KG		0.8U	0.8U	0.8U	0.9U	0.9U	UG/L 1U
TRICHLOROETHYLENE	UG/KG		0.6U	0.6U	0.6U	0.7U	0.7U	UG/L 1U
TRICHLOROFLUOROMETHANE	UG/KG		1U	1U	1U	1U	1U	UG/L 1U
VINYL CHLORIDE	UG/KG		0.8U	0.8U	0.8U	0.9U	0.9U	UG/L 1U

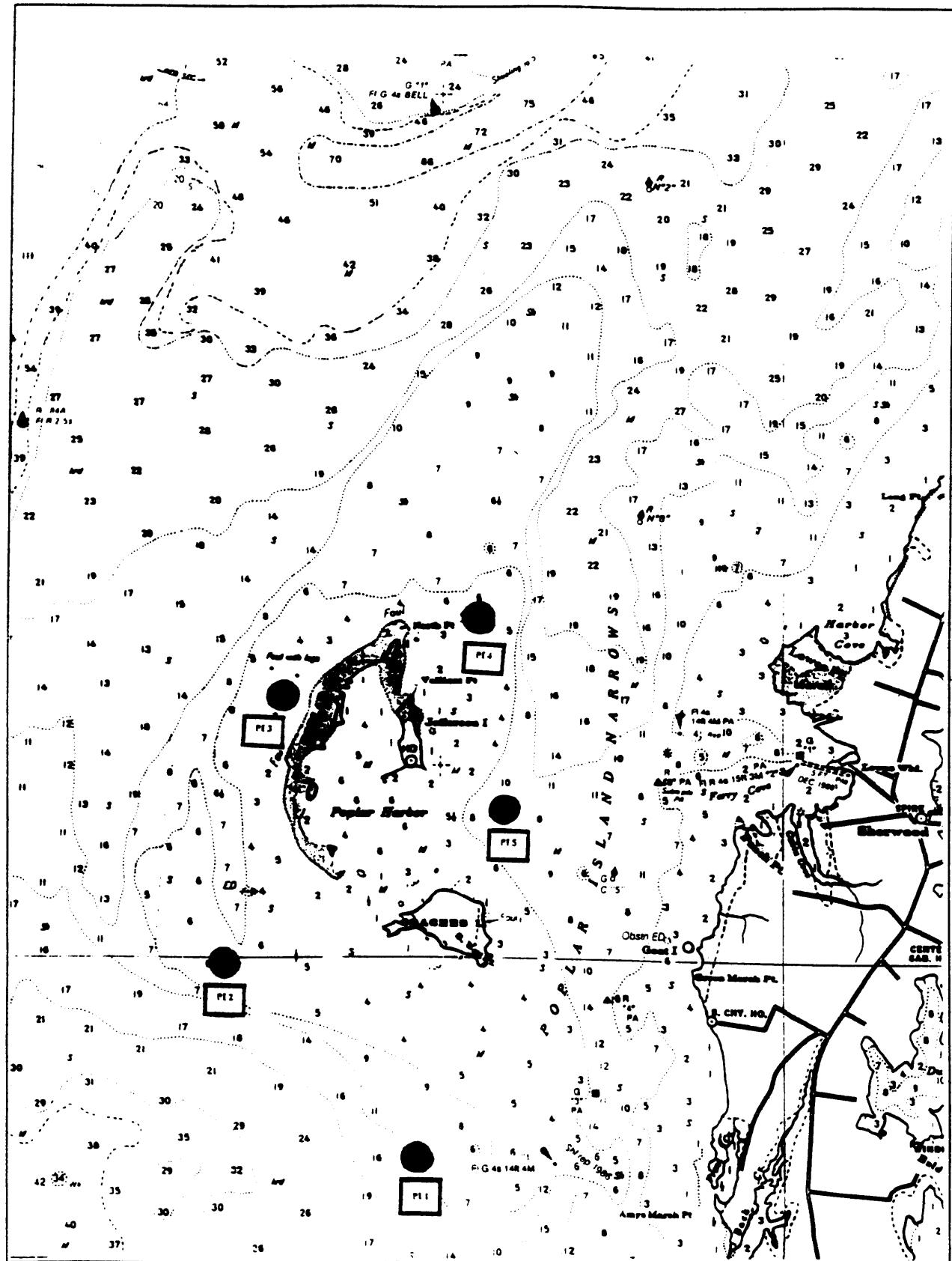
TOLCHESTER STRAIGHTENING SEDIMENT AND ELUTRIATE CHEMISTRY - 1995

ANALYTE	UNITS	SEDIMENT					ELUTRIATE	
	station ID core depth (ft)	TLV1 4.2 ft	TLV2 3.8 ft	TLV3 3.4 ft	TLV4 3.1 ft	TLV5 3.9 ft	UNITS	TLVEL
SEMICVOLATILE ORGANIC COMPOUNDS (SVOCs)								
1,2,4-TRICHLOROBENZENE	UG/KG	290U	270U	280U	310U	300U	UG/L	5U
1,2-DICHLOROBENZENE	UG/KG	390U	370U	380U	420U	410U	UG/L	4U
1,2-DIPHENYLHYDRAZINE	UG/KG	73U	69U	72U	80U	78U	UG/L	2U
1,4-DICHLOROBENZENE	UG/KG	370U	350U	360U	400U	390U	UG/L	4U
1-METHYLNAPHTHALENE	UG/KG	28U	27U	28U	170	30U	UG/L	10U
2,2'-OXYBIS(1-CHLOROPROPANE)	UG/KG	240U	230U	240U	270U	260U	UG/L	4U
2,4,5-TRICHLOROPHENOL	UG/KG	65U	62U	64U	71U	70U	UG/L	2U
2,4,6-TRICHLOROPHENOL	UG/KG	120U	120U	120U	130U	130U	UG/L	2U
2,4-DICHLOROPHENOL	UG/KG	120U	120U	120U	140U	130U	UG/L	3U
2,4-DIMETHYLPHENOL	UG/KG	330U	310U	320U	360U	350U	UG/L	4U
2,4-DINITROPHENOL	UG/KG	220U	210U	220U	240U	240U	UG/L	2U
2,4-DINITROTOLUENE	UG/KG	110U	100U	100U	120U	110U	UG/L	1U
2,6-DINITROTOLUENE	UG/KG	140U	130U	140U	160U	150U	UG/L	1U
2-CHLORONAPHTHALENE	UG/KG	120U	110U	120U	130U	130U	UG/L	3U
2-CHLOROPHENOL	UG/KG	240U	230U	240U	270U	260U	UG/L	4U
2-METHYL-4,6-DINITROPHENOL	UG/KG	130U	120U	120U	140U	130U	UG/L	2U
2-METHYLNAPHTHALENE	UG/KG	59	44	75	380	75	UG/L	4U
2-METHYLPHENOL	UG/KG	170U	160U	170U	190U	180U	UG/L	3U
2-NITROANILINE	UG/KG	120U	110U	120U	130U	130U	UG/L	1U
2-NITROPHENOL	UG/KG	220U	210U	220U	240U	240U	UG/L	4U
3,3'-DICHLOROBENZIDINE	UG/KG	590U	560U	580U	640U	630U	UG/L	10U
3,4-METHYLPHENOL	UG/KG	680	460	500	430	590	UG/L	3U
3,5,5-TRIMETHYL-2-CYCLOHEXENE-1-ONE	UG/KG	160U	150U	150U	170U	170U	UG/L	2U
3-NITROANILINE	UG/KG	430U	410U	430U	470U	460U	UG/L	4U
4-BROMOPHENYL PHENYL ETHER	UG/KG	63U	60U	62U	69U	67U	UG/L	3U
4-CHLORO-3-METHYLPHENOL	UG/KG	98U	92U	96U	110U	100U	UG/L	1U
4-CHLOROPHENYL PHENYL ETHER	UG/KG	130U	120U	130U	140U	140U	UG/L	3U
4-NITROPHENOL	UG/KG	130U	120U	120U	140U	130U	UG/L	1U
BENZIDINE	UG/KG	570U	540U	560U	620U	610U	UG/L	2U
BENZOIC ACID	UG/KG	780U	740U	770U	850U	830U	UG/L	2U
BENZYL ALCOHOL	UG/KG	180U	170U	180U	200U	200U	UG/L	2U
BENZYL BUTYL PHTHALATE	UG/KG	180U	170U	170U	190U	190U	UG/L	2U
BIS(2-CHLOROETHOXY)METHANE	UG/KG	170U	160U	160U	180U	180U	UG/L	4U
BIS(2-CHLOROETHYL) ETHER	UG/KG	290U	270U	280U	310U	300U	UG/L	4U
BIS(2-ETHYLHEXYL) PHTHALATE	UG/KG	270U	250U	260U	290U	280U	UG/L	7U
CARBAZOLE	UG/KG	100U	94U	98U	110U	110U	UG/L	2U
CYCLOHEXANONE	UG/KG	400U	380U	400U	440U	430U	UG/L	4U
DI-N-BUTYL PHTHALATE	UG/KG	100U	94U	98U	770	110U	UG/L	9
DI-N-OCTYL PHTHALATE	UG/KG	69U	65U	68U	76U	74U	UG/L	2U
DIBENZOFURAN	UG/KG	90U	85U	88U	98U	96U	UG/L	3U
DIETHYL PHTHALATE	UG/KG	98U	92U	96U	110U	100U	UG/L	3U
DIMETHYL PHTHALATE	UG/KG	84U	79U	82U	91U	89U	UG/L	4U
HEXAChLORO-1,3-BUTADIENE	UG/KG	310U	290U	300U	330U	330U	UG/L	5U
HEXAChLOROBENZENE	UG/KG	120U	120U	120U	130U	130U	UG/L	3U
HEXAChLOROCYCLOPENTADIENE	UG/KG	150U	140U	150U	160U	160U	UG/L	3U
HEXAChLOROETHANE	UG/KG	370U	350U	360U	400U	390U	UG/L	4U
M-DICHLOROBENZENE	UG/KG	390U	370U	380U	420U	410U	UG/L	4U
METHANAMINE, N-METHYL-N-NITROSO	UG/KG	330U	310U	320U	360U	350U	UG/L	4U
N-NITROSODI-N-PROPYLAMINE	UG/KG	160U	150U	160U	180U	170U	UG/L	3U
N-NITROSODIPHENYLAMINE	UG/KG	120U	120U	120U	140U	130U	UG/L	2U
NITROBENZENE	UG/KG	240U	230U	240U	270U	260U	UG/L	5U
P-CHLOROANILINE	UG/KG	540U	510U	530U	590U	580U	UG/L	6U
P-NITROANILINE	UG/KG	180U	170U	170U	190U	190U	UG/L	3U
PENTACHLOROPHENOL	UG/KG	140U	130U	140U	150U	150U	UG/L	2U
PHENOL	UG/KG	190U	180U	180U	200U	200U	UG/L	4U
PYRIDINE	UG/KG	240U	230U	240U	260U	260U	UG/L	6U

Detected concentrations are bolded and shaded.

NA=not applicable

NT= not tested



Grab sampling locations in the vicinity of Poplar Island – 1995

POPLAR ISLAND
SEDIMENT CHEMISTRY DATA - 1995

ANALYTE	UNITS (dry weight)	PI-1	PI-2	PI-3	PI-4	PI-5
INORGANIC NON-METALS						
CYANIDE	MG/KG	0.28U	0.95U	0.25U	0.28U	0.33U
NITROGEN, AMMONIA	MG/KG	7.6	19.2	3.4	4.9	73.6
NITROGEN, NITRATE AND NITRITE	MG/KG	146	7.6	2.1	4.3	6.3
NITROGEN, TOTAL KJELDAHL	MG/KG	106	515	132	27U	549
OXYGEN DEMAND, BIOCHEMICAL	MG/KG	397	571U	216	308	537
OXYGEN DEMAND, CHEMICAL	MG/KG	2680	6010	1340	1240	3380
PHOSPHORUS, TOTAL	MG/KG	61.4	147	61.8	36.6	115
SPECIFIC GRAVITY	T/4C	1.49	1.31	1.59	1.36	1.29
SULFIDE, TOTAL	MG/KG	41.4	102U	24.8U	28.4U	28.1U
TOTAL ORGANIC CARBON	MG/KG	3280	14400	2500	3620	3860
GRAIN SIZE DISTRIBUTION						
CLAY	%	0	0	0	0	0
GRAVEL	%	0	0	0	0	0.1
SAND	%	95.7	97.8	96.3	95.9	60.8
SILT	%	4.3	2.2	3.7	4.1	39.1
METALS						
ALUMINUM	MG/KG	2080	4820	1100	1290	4110
ANTIMONY	MG/KG	0.32BN	0.46UN	0.19BN	0.13UN	0.15UN
ARSENIC	MG/KG	1.3B	3B	1.5	0.94B	2
BERYLLIUM	MG/KG	0.14U	0.46U	0.13U	0.13U	0.2B
CADMIUM	MG/KG	0.17B	0.46U	0.13U	0.13U	0.37B
CHROMIUM	MG/KG	3.3	8.3	3.2	2.4	6.8
COPPER	MG/KG	2.1B	3.2B	0.51U	0.86B	3B
IRON	MG/KG	3620	7180	3240	2300	7170
LEAD	MG/KG	2.8	7.2	1.5	2.1	5
MANGANESE	MG/KG	65.8	126	33.8	43.4	132
MERCURY	MG/KG	0.06B	0.22U	0.06B	0.06B	0.1B
NICKEL	MG/KG	4.2B	10.9B	2.6B	3B	8.3
SELENIUM	MG/KG	0.48B	0.91U	0.25U	0.26U	0.68B
SILVER	MG/KG	0.41UN	1.4UN	0.38UN	0.4UN	0.45UN
THALLIUM	MG/KG	0.27UN	0.88UN	0.23UN	0.28UN	0.32UN
ZINC	MG/KG	22.1E	57E	10.4E	15.9E	42.2E
PCB AROCLORS						
AROCLOR 1016	UG/KG	5.9U	19U	5.1U	5.7U	6.4U
AROCLOR 1221	UG/KG	15U	48U	13U	14U	16U
AROCLOR 1232	UG/KG	4.4U	14U	3.8U	4.3U	4.8U
AROCLOR 1242	UG/KG	5.9U	19U	5.1U	5.7U	6.4U
AROCLOR 1248	UG/KG	1.5U	4.8U	1.3U	1.4U	1.6U
AROCLOR 1254	UG/KG	2.9U	10U	2.6U	2.8U	3.2U
AROCLOR 1260	UG/KG	1.5U	4.8U	1.3U	1.4U	1.6U
CHLORINATED PESTICIDES						
4,4'-DDD	UG/KG	3U	32U	2.3U	2.8U	3.6U
4,4'-DDE	UG/KG	0.62U	6.6U	0.48U	0.59U	0.74U
4,4'-DDT	UG/KG	3.4U	36U	2.6U	3.2U	4.1U
ALDRIN	UG/KG	0.34U	0.76U	0.2U	0.32U	0.41U
ALPHA-BHC	UG/KG	2.4U	25U	1.8U	2.2U	2.8U
BETA-BHC	UG/KG	0.21U	2.3U	0.16U	0.2U	0.25U
CHLORBENZIDE	UG/KG	4.9U	16U	4.2U	4.7U	5.2U
CHLORDANE	UG/KG	7.9U	84U	6.1U	7.5U	9.4U
DACTHAL	UG/KG	4.9U	16U	4.2U	4.7U	5.2U
DELTA-BHC	UG/KG	0.36U	3.9U	0.28U	0.34U	0.43U
DIELDRIN	UG/KG	2.8U	29U	2.1U	2.6U	3.3U
ENDOSULFAN I	UG/KG	0.21U	2.3U	0.16U	0.2U	0.25U
ENDOSULFAN II	UG/KG	0.49U	5.2U	0.38U	0.47U	0.58U
ENDOSULFAN SULFATE	UG/KG	1.1U	12U	0.84U	1U	1.3U
ENDRIN	UG/KG	3U	32U	2.3U	2.8U	3.6U
ENDRIN ALDEHYDE	UG/KG	0.21U	2.3U	0.16U	0.2U	0.25U
GAMMA-BHC	UG/KG	1.6U	17U	1.2U	1.5U	1.9U
HEPTACHLOR	UG/KG	1.8U	19U	1.4U	1.7U	2.1U
HEPTACHLOR EPOXIDE	UG/KG	0.15U	0.48U	0.13U	0.14U	0.16U
METHOXYPHENYL	UG/KG	18U	57U	15U	17U	19U
MIREX	UG/KG	4.9U	16U	4.2U	4.7U	5.2U
TOXAPHENE	UG/KG	110U	1200U	87U	110U	130U

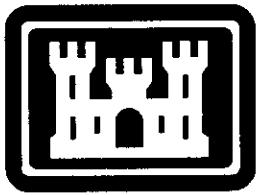
POPLAR ISLAND
SEDIMENT CHEMISTRY DATA - 1995

ANALYTE	UNITS (dry weight)	PI-1	PI-2	PI-3	PI-4	PI-5
ORGANOPHOSPHORUS PESTICIDES						
AZINPHOS METHYL	UG/KG	4.9U	16U	4.3U	4.8U	5.3U
DEMETON	UG/KG	4.9U	16U	4.3U	4.8U	5.3U
ETHYL PARATHION	UG/KG	4.9U	16U	4.2U	4.7U	5.2U
MALATHION	UG/KG	4.9U	16U	4.2U	4.7U	5.2U
METHYL PARATHION	UG/KG	4.9U	16U	4.2U	4.7U	5.2U
PAHs						
ACENAPHTHENE	UG/KG	20U	67U	18U	20U	22U
ACENAPHTHYLENE	UG/KG	35U	110U	31U	34U	38U
ANTHRACENE	UG/KG	2U	6.7U	1.8U	2U	2.2U
BENZ[A]ANTHRACENE	UG/KG	1U	3.3U	0.88U	0.98U	1.1U
BENZO[A]PYRENE	UG/KG	2.8U	9U	2.4U	2.7U	3U
BENZO[B]FLUORANTHENE	UG/KG	3.1U	10U	2.7U	3U	3.3U
BENZO[G,H,I]PERYLENE	UG/KG	2.8U	9U	2.4U	2.7U	3U
BENZO[K]FLUORANTHENE	UG/KG	1.3U	4.1U	1.1U	1.2U	1.4U
CHRYSENE	UG/KG	1.3U	4.2U	1.1U	1.3U	1.4U
DIBENZ[A,H]ANTHRACENE	UG/KG	1.4U	4.6U	1.2U	1.4U	1.5U
FLUORANTHENE	UG/KG	2.8U	9U	2.4U	2.7U	3U
FLUORENE	UG/KG	4.2U	14U	3.7U	4.1U	4.6U
INDENO[1,2,3-CD]PYRENE	UG/KG	2.3U	7.6U	2U	2.3U	2.6U
NAPHTHALENE	UG/KG	20U	67U	18U	20U	22U
PHENANTHRENE	UG/KG	1.4	4.7	1.1	1.2U	2.8
PYRENE	UG/KG	2.6U	8.6U	2.3U	2.6U	2.9U
TOTAL PAHS (ND=1/2)	UG/KG	52.7	171.75	46.59	51.09	58.8
TOTAL PAH (ND=DL)	UG/KG	104	338.8	92.08	102.18	114.8
VOLATILE ORGANIC COMPOUNDS (VOCs)						
1,1,1-TRICHLOROETHANE	UG/KG	0.4U	1U	0.4U	0.4U	0.5U
1,1,2,2-TETRACHLOROETHANE	UG/KG	0.6U	2U	0.5U	0.6U	0.6U
1,1,2-TRICHLOROETHANE	UG/KG	0.9U	3U	0.8U	0.9U	1U
1,1-DICHLOROETHANE	UG/KG	0.6U	2U	0.5U	0.6U	0.6U
1,1-DICHLOROETHYLENE	UG/KG	0.6U	2U	0.5U	0.6U	0.6U
1,2-DICHLOROETHANE	UG/KG	0.9U	3U	0.8U	0.9U	1U
1,2-DICHLOROPROPANE	UG/KG	1U	3U	0.9U	1U	1U
2-BUTANONE	UG/KG	1U	4U	1U	1U	1U
2-CHLOROETHYL VINYL ETHER	UG/KG	0.6U	2U	0.5U	0.6U	0.6U
ACROLEIN	UG/KG	7U	22U	6U	7U	7U
ACRYLONITRILE	UG/KG	5U	15U	4U	4U	5U
BENZENE	UG/KG	0.6U	2U	0.5U	0.6U	0.6U
BROMODICHLOROMETHANE	UG/KG	0.7U	2U	0.6U	0.7U	0.8U
BROMOMETHANE	UG/KG	0.7U	2U	0.6U	0.7U	0.8U
CARBON TETRACHLORIDE	UG/KG	0.3U	1U	0.3U	0.3U	0.3U
CHLOROBENZENE	UG/KG	0.4U	1U	0.4U	0.4U	0.5U
CHLORODIBROMOMETHANE	UG/KG	0.9U	3U	0.8U	0.9U	1U
CHLOROETHANE	UG/KG	1U	4U	1U	1U	1U
CHLOROFORM	UG/KG	0.6U	2U	0.5U	0.6U	0.6U
CHLOROMETHANE	UG/KG	1U	4U	1U	1U	1U
CIS-1,3-DICHLOROPROPENE	UG/KG	0.4U	1U	0.4U	0.4U	0.5U
DICHLORODIFLUOROMETHANE	UG/KG	0.9U	3U	0.8U	0.9U	1U
DICHLOROMETHANE	UG/KG	0.9U	3U	0.8U	0.9U	1U
ETHYLBENZENE	UG/KG	0.7U	2U	0.6U	0.7U	0.8U
METHYLBENZENE	UG/KG	0.4U	1U	0.4U	0.4U	0.5U
TETRACHLOROETHENE	UG/KG	0.7U	2U	0.6U	0.7U	0.8U
TRANS-1,2-DICHLOROETHENE	UG/KG	0.9U	3U	0.8U	0.9U	1U
TRANS-1,3-DICHLOROPROPENE	UG/KG	0.7U	2U	0.6U	0.7U	0.8U
TRIBOMOMETHANE	UG/KG	0.6U	2U	0.5U	0.6U	0.6U
TRICHLOROETHYLENE	UG/KG	0.4U	1U	0.4U	0.4U	0.5U
TRICHLOROFUROMETHANE	UG/KG	0.7U	2U	0.6U	0.7U	0.8U
VINYL CHLORIDE	UG/KG	0.6U	2U	0.5U	0.6U	0.6U

POPLAR ISLAND
SEDIMENT CHEMISTRY DATA - 1995

ANALYTE	UNITS (dry weight)	PI-1	PI-2	PI-3	PI-4	PI-5
SEMOVOLATILE ORGANIC COMPOUNDS (SVOCs)						
1,2,4-TRICHLOROBENZENE	UG/KG	210U	670U	180U	200U	220U
1,2-DICHLOROBENZENE	UG/KG	280U	900U	240U	270U	300U
1,2-DIPHENYLHYDRAZINE	UG/KG	53U	170U	46U	51U	57U
1,4-DICHLOROBENZENE	UG/KG	260U	860U	230U	260U	290U
1-METHYLNAPHTHALENE	UG/KG	20U	67U	18U	20U	22U
2,2'-OXYBIS(1-CHLOROPROPANE)	UG/KG	180U	570U	150U	170U	190U
2,4,5-TRICHLOROPHENOL	UG/KG	47U	150U	41U	46U	51U
2,4,6-TRICHLOROPHENOL	UG/KG	88U	290U	77U	86U	95U
2,4-DICHLOROPHENOL	UG/KG	90U	290U	78U	87U	97U
2,4-DIMETHYLPHENOL	UG/KG	240U	760U	210U	230U	250U
2,4-DINITROPHENOL	UG/KG	160U	520U	140U	160U	170U
2,4-DINITROTOLUENE	UG/KG	76U	250U	67U	74U	83U
2,6-DINITROTOLUENE	UG/KG	100U	330U	90U	100U	110U
2-CHLORONAPHTHALENE	UG/KG	87U	280U	76U	84U	94U
2-CHLOROPHENOL	UG/KG	180U	570U	150U	170U	190U
2-METHYL-4,6-DINITROPHENOL	UG/KG	91U	300U	79U	89U	98U
2-METHYLNAPHTHALENE	UG/KG	20U	67U	18U	20U	22U
2-METHYLPHENOL	UG/KG	120U	400U	110U	120U	130U
2-NITROANILINE	UG/KG	85U	280U	74U	83U	92U
2-NITROPHENOL	UG/KG	160U	520U	140U	160U	170U
3,3'-DICHLOROBENZIDINE	UG/KG	430U	1400U	370U	410U	460U
3,4-METHYLPHENOL	UG/KG	120U	380U	100U	110U	130U
3,5,5-TRIMETHYL-2-CYCLOHEXENE-1-ONE	UG/KG	110U	360U	97U	110U	120U
3-NITROANILINE	UG/KG	310U	1000U	270U	300U	340U
4-BROMOPHENYL PHENYL ETHER	UG/KG	46U	150U	40U	44U	49U
4-CHLORO-3-METHYLPHENOL	UG/KG	71U	230U	62U	69U	76U
4-CHLOROPHENYL PHENYL ETHER	UG/KG	96U	310U	83U	93U	100U
4-NITROPHENOL	UG/KG	91U	300U	79U	89U	98U
BENZIDINE	UG/KG	410U	1300U	360U	400U	440U
BENZOIC ACID	UG/KG	560U	1800U	490U	550U	610U
BENZYL ALCOHOL	UG/KG	130U	430U	120U	130U	140U
BENZYL BUTYL PHTHALATE	UG/KG	130U	410U	110U	120U	140U
BIS(2-CHLOROETHOXY)METHANE	UG/KG	120U	390U	100U	120U	130U
BIS(2-CHLOROETHYL) ETHER	UG/KG	210U	670U	180U	200U	220U
BIS(2-ETHYLHEXYL) PHTHALATE	UG/KG	190U	620U	170U	190U	210U
CARBAZOLE	UG/KG	72U	230U	63U	70U	78U
CYCLOHEXANONE	UG/KG	290U	940U	250U	280U	310U
DI-N-BUTYL PHTHALATE	UG/KG	72U	660	180	150	78U
DI-N-OCTYL PHTHALATE	UG/KG	50U	160U	44U	49U	54U
DIBENZOFURAN	UG/KG	65U	210U	56U	63U	70U
DIETHYL PHTHALATE	UG/KG	71U	230U	62U	69U	76U
DIMETHYL PHTHALATE	UG/KG	60U	200U	53U	59U	65U
HEXAChLORO-1,3-BUTADIENE	UG/KG	220U	710U	190U	210U	240U
HEXAChLOROBENZENE	UG/KG	88U	290U	77U	86U	95U
HEXAChLOROCYCLOPENTADIENE	UG/KG	110U	350U	95U	110U	120U
HEXAChLOROETHANE	UG/KG	260U	860U	230U	260U	290U
M-DICHLOROBENZENE	UG/KG	280U	900U	240U	270U	300U
METHANAMINE, N-METHYL-N-NITROSO	UG/KG	240U	760U	210U	230U	250U
N-NITROSODI-N-PROPYLAMINE	UG/KG	120U	380U	100U	110U	130U
N-NITROSODIPHENYLAMINE	UG/KG	90U	290U	78U	87U	97U
NITROBENZENE	UG/KG	180U	570U	150U	170U	190U
P-CHLORoANILINE	UG/KG	390U	1300U	340U	380U	420U
P-NITROANILINE	UG/KG	130U	410U	110U	120U	140U
PENTACHLOROPHENOL	UG/KG	100U	330U	88U	99U	110U
PHENOL	UG/KG	130U	430U	120U	130U	140J
PYRIDINE	UG/KG	170U	560U	150U	170U	190U

Detected concentrations are bolded and shaded.



**US Army Corps
of Engineers
Baltimore District**

February 2000

**Tolchester Channel Realignment
Subsurface Investigation
Tolchester Beach
Maryland**

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1.0 INTRODUCTION

This report presents the results of the subsurface investigation conducted to physically characterize sediment samples collected from the proposed channel realignment near the Tolchester Channel S-Turn approximately $\frac{1}{2}$ mile south of Tolchester Beach, Maryland. The study encompassed a 10,000 foot long alternative channel to the S-Turn channel currently used by deep draft commercial shipping lines. The Tolchester Channel Realignment Subsurface Investigation consisted of completing subsurface sampling of bottom sediments from 10 borings along the new channel to -45 Mean Lower Low Water (MLLW) datum and the testing of select representative samples to determine their physical characteristics. Data gathered from this study will be used to define dredge methods for the potential excavation of the proposed new channel. The offshore subsurface investigation was performed by the Baltimore District's Field Investigation Unit (FEU). The Baltimore District's Hydrographic Survey Section was also present during all sampling activities and provided the field sampling crew with adjustment directions for boring locations and final coordinates for each boring.

2.0 SCOPE OF INVESTIGATION & EQUIPMENT

2.1 Boring Locations: Ten (10) borings were completed along the length of the proposed realignment channel between September 27, 1999 and October 1, 1999. The sampling locations were selected and coordinates determined for each boring by the project team members of Baltimore District's Navigation Support and Geology & Investigation Sections. Each boring's location was selected to maximize investigation of the area of interest and was spaced along 1000 foot intervals throughout the area of study. See Plate 1, Boring Plan, for locations of borings. Boring locations were marked by the Navigation Support Section's Hydrographic Unit using weighted buoys prior to the barge's movement into position for sampling. The sampling datum for all borings was MLLW. TABLE 1, "SUMMARY OF SAMPLING DATA", summarizes general geotechnical information gathered during this study.

2.2 Drilling Equipment & Platform: All borings were completed offshore using a truck mounted Acker AD II drilling rig secured onboard a floating platform (44' wide by 110' long barge). The Acker AD II model 300GF has an engine RPM of 2800 with a down hole torque of 6725 lbs-ft and a lifting capacity rated at 7050 lb. A twin engine workboat built by Marine Inland Fabricators and powered by 671 Detroit diesels was used to navigate and position the barge over each boring location.

TABLE 1
SUMMARY OF SAMPLING DATA

Channel Name	Boring Number	Boring Coordinates**		Linear Feet Sampled	BOH Elevation (ft.)	Soil Type(s) (USCS)
		Easting	Northing			
TOLCHESTER	DH-1	1518699.05	556673.83	14 feet	-46.3 MLLW	CH/OH
TOLCHESTER	DH-2	1519552.60	557238.11	16 feet	-45.6 MLLW	CH
TOLCHESTER	DH-3	1519961.08	558187.18	20 feet	-46.5 MLLW	CH
TOLCHESTER	DH-4	1520852.83	558781.08	20 feet	-45.1 MLLW	CH
TOLCHESTER	DH-5	1521307.02	559725.74	20 feet	-45.3 MLLW	CH
TOLCHESTER	DH-6	1522182.98	560300.25	22 feet	-44.2 MLLW	CH/OH
TOLCHESTER	DH-7	1522649.14	561219.73	24 feet	-45.1 MLLW	OH/CH
TOLCHESTER	DH-8	1523464.22	561767.26	20 feet	-45.8 MLLW	CH
TOLCHESTER	DH-9	1524118.69	563387.39	12 feet	-45.3 MLLW	CH/OH
TOLCHESTER	DH-10	1524032.45	562576.34	10 feet	-46.1 MLLW	CH

** Maryland State Plane Coordinate System (NAD 83)

2.3 Boring Positioning: Coordinates for each boring were established by marker buoy utilizing a Starlink D-NAV 212G Differential Global Positioning System (DGPS). Buoy markers were used for navigating boat and barge to a position as close as possible to the sampling coordinates. The final barge platform boring coordinates were checked by the surveyors using the Starlink D-NAV 212G Differential Global Positioning System (DGPS). Once boat and barge were moored the receiving antenna of the DGPS was positioned over the spud well to collect final boring coordinates. The DGPS obtained position using the local U.S. Coast Guard Stations. The precision of the DGPS system is rated as sub-meter (3 feet) or better.

2.4 Sediment Sampling Method: Sediment was sampled using the Standard Penetration Test (SPT) method. The planned investigation sampling depth was the -45.0 Mean Lower Low Water (MLLW) datum or a SPT penetration refusal of less than 0.2 feet of penetration per 100 blows. All borings were sampled continuously in 2' increments by the SPT method from the channel floor to a depth of -45.0 feet below MLLW. The SPT method consisted of driving a 1 $\frac{3}{8}$ inch ID by two foot eight inch (2'8") long split spoon sampler with a 140 pound hammer free falling thirty inches. Each boring was prevented from inward collapse (or caving) during sampling by using 4" I.D. stainless steel casing. The stainless steel casing was flushed and then lowered to the top of the next sampling depth before collection of each sediment sample. Recovered sediments for each split spoon were then placed in an air tight glass jar for shipment to the laboratory. The number of blows counts required to advance the sample spoon 0.5 feet in each foot of drive were recorded. A total of 178 linear feet (approximately 356 SPT 0.5 foot sample lengths) of sediment were sampled from the 10 subsurface borings. All (100%) of the split spoon drives were advanced either by weight of rods (WR) or weight of hammer (WH) with out any hammer blows. The SPT method provides a disturbed sample for defining sediment stratification as well as blow count data (N-Values) which gives an indication of soil consistency and relative density.

2.5 Channel Depth and Tidal Information: Water soundings were obtained mechanically at the start of each borehole. A perforated steel plate was suspended from a fiberglass measuring tape once the barge was securely anchored at each sampling location. Tidal readings were obtained from NOAA's automated gauge located on Ft. McHenry Pier, Ft. McHenry National Park, Baltimore Maryland at the start of each borehole. The corrected depth necessary to reach -45.0 MLLW was then calculated. The Ft. McHenry automated gauge has been surveyed from local bench marks. Fort McHenry bench mark data and locations are included in Appendix F.

3.0 LABORATORY TESTING PROCEDURE

All geotechnical soil tests were performed by the Baltimore District's Material and Instrumentation Unit. A Total of 89 sample jars were collected during this subsurface investigation. Visual classifications of all jar samples were completed by an experienced soils technician, and a total number of 20 jar samples were selected for Atterberg limits, mechanical analysis (grain size), organic content, unit weight, specific gravity, and water content testing. All soil testing was performed in accordance with EM 1110-2-1906. Upon completion of the testing, all samples were assigned a soil classification in conformance with the Unified Soil Classification System (USCS). TABLE 2, "SUMMARY OF TESTING DATA", summarizes the laboratory test results performed on sediment samples selected for testing. Visual-Manual Classifications are presented in Appendix A. Laboratory Test Results and Grain Size Analysis are located in Appendix B.

TABLE 2
SUMMARY OF TESTING DATA

Boring Number	Sample Number	Specific Gravity	Moisture Content %	% L.O.I. (Loss On Ignition)	Organic Classification	In-Situ Density (lb/ft ³) ¹	In-Situ Density (lb/ft ³) ²
DH-1	Jar 1&2*	2.65	138.0	8.3	Inorganic	82.2	84.5
DH-1	Jar 4	2.58	113.1	12	Organic	86.3	87.6
DH-2	Jar 1	2.62	125.5	8.4	Inorganic	83.4	86.0
DH-2	Jar 5	2.67	102.0	11.0	Inorganic	88.2	90.4
DH-3	Jar 6	2.64	108.1	9.1	Inorganic	87.0	89.0
DH-3	Jar 10	2.66	108.2	9.0	Inorganic	87.2	89.1
DH-4	Jar 1&2*	2.62	128.9	8.5	Inorganic	84.5	85.5
DH-4	Jar 9	2.65	100.5	7.3	Inorganic	88.9	90.5
DH-5	Jar 3	2.59	118.5	11.9	Inorganic	86.1	86.8
DH-5	Jar 8	2.69	104.2	7.1	Inorganic	89.1	90.1
DH-6	Jar 3	2.54	109.9	14.0	Organic	84.7	87.7
DH-6	Jar 11	2.67	115.9	7.1	Inorganic	88.8	87.9
DH-7	Jar 3	2.56	107.5	14.2	Organic	86.1	88.3
DH-7	Jar 6	2.69	104.6	8.8	Inorganic	88.3	90.1
DH-8	Jar 4	2.65	106.5	11.4	Inorganic	88.2	89.3
DH-8	Jar 9	2.69	100.2	6.7	Inorganic	87.3	90.9
DH-9	Jar 2	2.63	122.9	10.6	Inorganic	86.3	86.4
DH-9	Jar 6	2.59	108.0	14.0	Organic	87.3	88.5
DH-10	Jar 3	2.62	121.7	10.7	Inorganic	85.6	86.5
DH-10	Jar 5	2.61	107.6	11.0	Inorganic	88.6	88.8

* Jar samples were combined to attain required amount of sediment necessary to complete testing

¹ These values were obtained using a pycnometer of known weight and volume

² These values were calculated form the Specific Gravity assuming 100% saturation

4.0 REGIONAL GEOLOGY

The Tolchester Beach area is located in the Atlantic Coastal Plain Physiographic Province and is underlined by sequences of clays, silts, sands, and gravels. These geologically unconsolidated sediments date from the Cretaceous, Tertiary, and Quaternary periods and dip in a southeasterly direction towards the Atlantic Ocean. The unconsolidated sediments are underlain by Precambrian and/or Paleozoic period rock that are referred to as the "basement rocks." These basement rocks are exposed at the ground surface several miles to the north and west along a northeast trending geological structural feature known as the "Fall Line." Along the Atlantic Coast, the Fall Line marks the boundary between two physiographic provinces - the Piedmont and Atlantic Coastal Plain physiographic provinces. From the Fall Line boundary, the Atlantic Coast slopes in a series of wedge-shaped sediment layers which thicken seaward.

4.1 Basement Rocks: The elevation of crystalline bedrock below the project area is estimated at between 500 and 800 feet below sea level. Geologic studies indicate that the basement rocks are a complex lithology composed of schist, gneiss, gabbro, and granite with smaller amounts of quartzite, marble, and granite pegmatite. The basement rocks were not encountered during this study.

4.2 Stratigraphy of the Tolchester Channel Area: Bedding of unconsolidated sedimentary units generally strike northeast-southwest and dips southeast at very low angles, mostly much less than 1°. The regional geology from the oldest to the youngest formations in the Tolchester Channel area are as follows: the Potomac Group (which includes the Patapsco, Arundel and Patuxent Formations), the Magothy Formation, the Severn and Matawan Formations (undifferentiated), the Brightseat Formation, the Aquia Formation, the Namjemoy Formation, the Piney Point Formation, and the Calvert Formation. The Calvert Formation is overlain by Holocene (recent) unconsolidated, soft sedimentary units of sand, silt, and clay and is extremely variable.

4.3 Sediments of the Proposed Tolchester Realignment Channel To -45 MLLW: Sediment encountered in the proposed Tolchester Realignment Channel consisted of Holocene (Recent) deposits of very soft, plastic and organic clays. These sediments are fluvial in origin and were deposited on the eroded surfaces of stratigraphic units present in this area of the Chesapeake Bay. The recent sediments are generally much softer than the underlying formation sediments with the uppermost layers of the recent deposits typically being a fluid mud.

5.0 INTERPRETATION OF RESULTS:

The following sections discuss the subsurface investigation results of the area proposed as the Tolchester Realignment Channel. Testing conducted for this study focused on the geotechnical engineering soil properties that govern the excavation stage of a dredging project. Engineering and rheologic soil properties that govern the transportation stages (pumping or barge) or the disposal stage (dumping and compaction) are not discussed. Sediment and associated properties are described according to recommendations suggested

in U.S. Waterway Experiment Station (WES) Laboratory report "Geotechnical Factors in the Dredgeability of Sediments - Geotechnical Descriptors for Sediments to be Dredged". N-values were calculated by adding the last two blow counts for each 2 foot drive. Interpretation of surface geologic conditions (profiles) were beyond the scope of this study and were not constructed. TABLE 3, "LIQUIDITY, ACTIVITY, AND PLASTIC INDEXES", summarizes calculations completed on tested samples. Final Boring Logs are included in Appendix C. Index Calculations are presented in Appendix D. The inspecting geologist's Field Boring Logs (not finalized by laboratory test results) are included in Appendix E.

TABLE 3
LIQUIDITY, ACTIVITY, AND PLASTIC INDEXES

Boring Number	Sample Number	% -0.002mm Screen	N-Values	Liquidity Index	Activity Index	Plastic Index
DH-1	Jar 1&2	24%	WR	1.74	2.42	58
DH-1	Jar 4	29%	WR	1.71	1.55	45
DH-2	Jar 1	29%	WR	1.63	1.90	55
DH-2	Jar 5	29%	WR	1.44	1.66	48
DH-3	Jar 6	37%	WR	1.69	1.22	45
DH-3	Jar 10	38%	WH	1.36	1.42	54
DH-4	Jar 1&2	32%	WR	1.64	1.81	58
DH-4	Jar 9	27%	WH	1.50	1.67	45
DH-5	Jar 3	30%	WR	1.59	1.73	52
DH-5	Jar 8	30%	WR	1.28	1.83	55
DH-6	Jar 3	35%	WR	1.66	1.29	45
DH-6	Jar 11	35%	WH	1.19	1.92	68
DH-7	Jar 3	32%	WR	1.50	1.53	49
DH-7	Jar 6	35%	WR	1.28	1.60	56
DH-8	Jar 4	38%	WR	1.46	1.29	49
DH-8	Jar 9	34%	WR	1.45	1.38	47
DH-9	Jar 2	40%	WR	1.78	1.25	50
DH-9	Jar 6	36%	WR	1.57	1.31	47
DH-10	Jar 3	31%	WR	1.59	1.74	57
DH-10	Jar 5	36%	WR	1.76	1.19	43
Average =				1.54	51	51
Standard Deviation (1σ) =				0.17	6.27	6.27

5.1 Sediment Classification: Sediment encountered in all borings consisted of black to dark olive gray, slightly organic, very soft, high plasticity clay (CH) or a black to dark olive gray, organic, very soft, high plasticity organic clay (OH). Sand particles present in some borings ranged in size from the #10 to #200 screens (very fine sand) and was only present in trace amounts (<15%). Approximately 98% of all sand analyzed was smaller than the #100 screen.

5.2 Sediment Properties: All of the sediment encountered in the study area consists of a slightly organic to organic cohesive material (plastic clay CH or plastic organic clay OH) with high Liquid Limits and high Water Content and low consistency. Factors governing granular soil behavior including abrasive wear on machinery can be ignored from all material from these borings. All penetrometer readings in sediment samples were 0 tons/ft² and indicates a low shear strength soil with an associated in-situ shear strength of less than

25 kPa. All sediment material was penetrated by weight of rod or weight of hammer resulting in N-Values that are 0 for each 0.5 foot length of CH or OH material sampled. Table 4, "N-Values and Penetrometer Measurements" summarizes results of field measurements. Densities of sediment tested by a pycnometer ranged from 82.2 to 88.6 lb/ft³. The calculated Plastic Index (PI) value for the all tested samples exceeded 35 indicating non-friable properties. The Liquidity Index (LI) for each sediment sample tested was also greater than 1.0 indicating a "fluid-mud". The Activity Index calculated for all sediment samples suggests that the clay present is an illite (intermediate activity 1-2).

TABLE 4
N-VALUES AND PENETROMETER MEASUREMENTS

Boring Number	Depth (ft - MLLW)	N-Values ¹	Penetrometer Readings ²
DH-1	32.3 - 46.3	WR	0.0
DH-2	29.6 - 43.6	WR	0.0
DH-2	43.6 - 45.6	WH	0.0
DH-3	26.5 - 44.5	WR	0.0
DH-3	44.5 - 46.5	WH	0.0
DH-4	25.1 - 37.1	WR	0.0
DH-4	37.1 - 45.1	WH	0.0
DH-5	25.3 - 43.3	WR	0.0
DH-5	43.3 - 45.3	WH	0.0
DH-6	22.2 - 42.2	WR	0.0
DH-6	42.2 - 44.2	WH	0.0
DH-7	21.1 - 39.1	WR	0.0
DH-7	39.1 - 43.1	WH	0.0
DH-7	43.1 - 45.1	WR	0.0
DH-8	20.8 - 45.8	WR	0.0
DH-9	33.3 - 45.3	WR	0.0
DH-10	36.1 - 46.1	WR	0.0

¹N-Values were collected for each 0.5 linear feet sampled.
 N-Values were calculated by adding the last two 0.5 foot N-Values for each 2.0 foot length of sediment sampled and are summarized in this column for depths indicated.

²Three Penetrometer readings were collected for each 2.0 foot split spoon collects. Penetrometers readings are summarized in this column for depths indicated.

6.0 SUMMARY OF RESULTS

Sediment encounter in all borings of this investigation consisted of a very soft, low shear strength, slightly organic plastic clay or organic plastic clay (CH or OH). All samples are Holocene (recent) epoch sediments. Overall, sediment encountered during this study of the Tolchester Realignment Channel (investigation depth of -45.0 feet MLLW) are expected to be dredgeable by mechanical methods using buckets, grabs, scoops, or shovels without encountering major problems except the cutability during excavation, stickiness of the plastic or elastic material, and slope stability during excavation.

6.1 Cutability: Cutability is directly related to the in-situ shear strength (compactness/consistency/cementation) which is in turn, is directly affected by in-situ

density, degree of saturation, grain size distribution, clay content and clay mineral type, adhesion to the cutting surface, and amount of cementation, if any. A scoop (bucket, clamshell, etc.) uses a cutting edge to dislodge a mass of soil mechanically. The cutting resistance of a granular soil is affected by negative pore pressure caused by rapid shear: the finer the granular soil the greater the resistance. The cutting resistance of a cohesive soil is directly related to shear strength as measured by its consistency. Sediment encountered in the project study area consisted of a soil material of a very soft consistency with shear strengths less than 25 kPa. However, all sediment samples tested consisted of a highly plastic clay material with fines smaller than the -0.002 screen exceeding 24% percent by weight. Additionally samples tested were calculated to have Activity Indexes in the intermediate activity range. Therefore the higher the liquid limits and/or plasticity indexes (and therefore higher clay content: >24% by weight), the greater the cohesiveness, the stickiness and lesser friability of the clay. This high percentage of very fine, intermediate activity clay can be expected to decrease ease of cutting by increasing shear strength due to increased water suction (negative pore water pressure).

6.2 Adhesion: While tests for adhesion and stickiness are not well established, studies have shown that low consistency clay material with PI values exceeding 35 will show no degradation when excavating and will tend adhere in clumps to form clay balls and or mounds. A problem that may be encountered with mechanical dredging will be with the stickiness of the clay material. As Water Content of a saturated clay becomes greater than the Plastic Limit (liquidity index greater than zero), the availability of free water for metal adhesion becomes greater allowing the clay to bond with metal.

6.3 Slope Stability: During excavation of the low shear strength, low density, saturated sediment encountered in the proposed realignment channel, it can be expected that slumping (slope failure) of sediments may occur using a slope cuts of 3:1 or steeper (i.e. 2:1). Based on N-Values and field penetrometer readings it is expected that a long term slope cut of 2:1 would not be stable and that a log term slope cut of 3:1 may likewise show sediment slumping or similar movement towards the excavated channel. Slope cuts should be analyzed during channel design for slope stability in order to estimate of volume of material to be dredged.

It is important that the bidders are provided this information so that an accurate bid can be performed. Questions on this subsurface investigation should be directed to the author, Michael Saint-Clair at (410) 962-6648.

PLATES

CONTRACTOR'S NOTE
THE BIDDER TO THE SATISFACTION OF THE OWNER,
THE COORDINATE SHOWN ON THESE PLANS PROVIDED
BY CONTRACTOR STAND OUT SHORE STATION LOCATIONS
FOR THE CONSTRUCTION OF ANY OTHER ENGINEERING PURPOSES.
THE COMPT. OF ENGINEERS IS NOT RESPONSIBLE FOR
ANY CONSTRUCTION THAT IS NOT DERIVED FROM THE
DRAWINGS CONTRACTOR HAS PROVIDED.
ON PLANS PROVIDED BY THE BIDDING OR CONSTRUCTION.

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STATION ARE AT HIGH ALTITUDES.
THE INFORMATION INDICATED ON THE MAPS REPRESENTS RESULTS
OF SURVEYS MADE ON THE DATES INDICATED AND CAN ONLY BE
DETERMINED AS TO WHETHER THE GEOFIGURE CONDITIONS
EXISTED ON THOSE DATES.
VERTICAL DATUM IS NAVY MEAN HIGH TIDE, EPOCH
HONOLULU, HAWAII, NORTH AMERICAN 1927 Datum, WHILST
STATION IS IN COORDINATE SYSTEM
INDICATED BY THE LATITUDE AND LONGITUDE
POSITIONING SYSTEM.
THE POSITIONING SYSTEM IS IN AN EARTH-CENTERED,
SOUTH-UP COORDINATE SYSTEM AND HAS A
ZERO (0) DEGREE ZERO (0') TRUE NORTHEAST.
PROJECT NORTH 25 FEET
CHANNEL WIDTH IS ONE FEET.
SURVEYED POINTS ARE IN THE E.H. ALTY. 1997.

~~200 400~~ 0 ~~200~~ ~~400~~
SCALE IN FEET

5741-124-004

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111

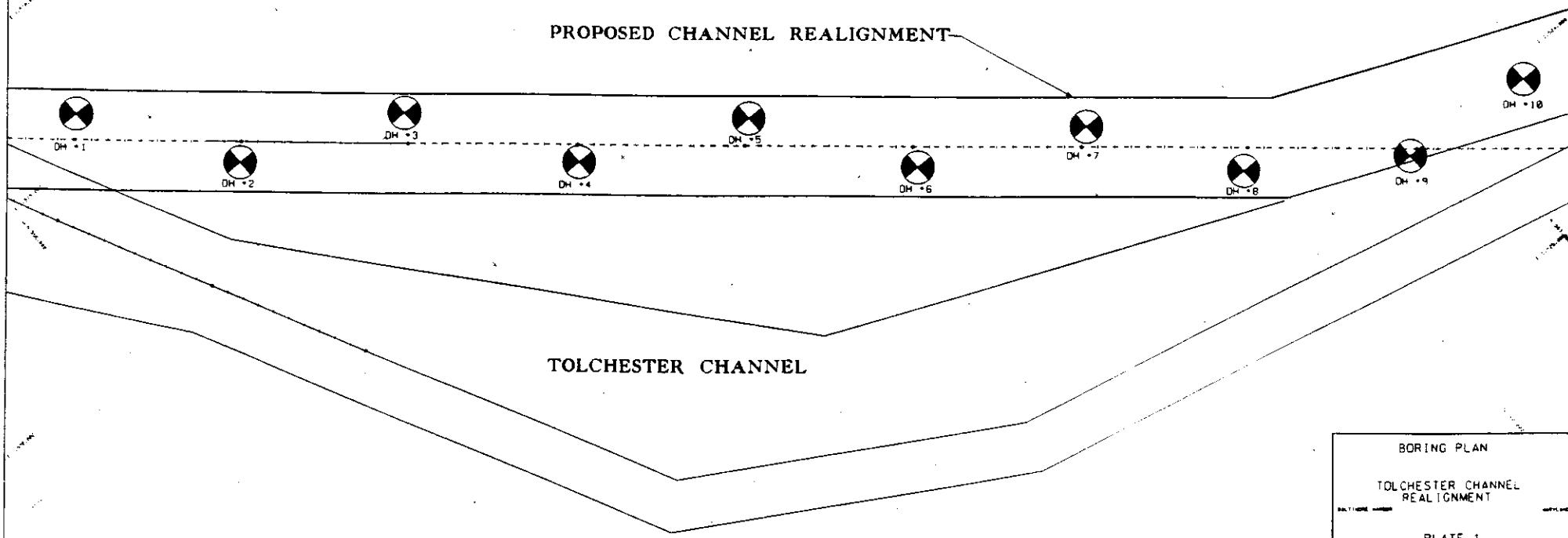
Section 32-60

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PROPOSED CHANNEL REALIGNMENT-

TOLCHESTER CHANNEL



BORING PLAN
TOLCHESTER CHANNEL
REALIGNMENT

PLATE 1

APPENDIX A

VISUAL-MANUAL CLASSIFICATIONS

VISUAL-MANUAL CLASSIFICATIONS

PROJECT: Tolchester Channel Realignment

DATE: Oct. 99

AREA: Kent County, MD

Classified by: shape

VISUAL-MANUAL CLASSIFICATIONS

PROJECT: Tolchester Channel Realignment

DATE: Oct. 99

AREA: Kent County, MD

Classified by: Sharpe

Sample No.	Depth (ft.)	Visual Classification	Symbol
	<u>DH-3</u>		
<i>very small sample</i> Jar-1	26.5-28.5	wet, black & olive gray, fat clay (tr. fine sand) (CH)	(CH)
Jar-2	28.5-30.5	Ditto	(CH)
Jar-3	30.5-32.5	Ditto	(CH)
Jar-4	32.5-34.5	Ditto	(CH)
Jar-5	34.5-36.5	Ditto	(CH)
Jar-6	36.5-38.5	wet, blk. & olive, ditto	(CH)
Jar-7	38.6-40.5	wet, blk. & ol. gray, ditto	(CH)
Jar-8	40.5-42.5	Ditto	(CH)
Jar-9	42.5-44.5	Ditto	(CH)
Jar-10	44.5-46.5	Ditto	(CH)
	<u>DH-4</u>		
<i>very small sample</i> Jar-1	25.1-27.1	wet, black & olive gray, fat clay w/sand ^①	(CH)
<i>very small sample</i> Jar-2	27.1-29.1	Ditto	(CH)
Jar-3	29.1-31.1	wet, blk. & ol. gray, fat clay (tr. fine sand) (CH)	(CH)
Jar-4	31.1-33.1	Ditto	(CH)
Jar-5	33.1-35.1	Ditto	(CH)
Jar-6	35.1-37.1	Ditto	(CH)
Jar-7	37.1-39.1	Ditto	(CH)
Jar-8	39.1-41.1	wet, blk. & olive, ditto	(CH)
Jar-9	41.1-43.1	wet, blk. & ol. gray, ditto	(CH)
Jar-10	43.1-45.1	Ditto	(CH)
		1. Fine sand	

VISUAL-MANUAL CLASSIFICATIONS

PROJECT: Tolchester Channel Realignment

DATE: Oct. 99

AREA: Kent County, MD

Classified by: Sharpe

Sample No.	Depth (ft.)	Visual Classification	Symbol
	DH-5		
Very small sample			
Jar-1	25.3-27.3	wet, black & olive gray, fat clay (tr. fine sand) (CH)	(CH)
Jar-2	27.3-29.3	Ditto	(CH)
Jar-3	29.3-31.3	wet, black & ol. gray, fat clay w/sand (CH)	(CH)
Jar-4	31.3-33.3	Ditto	(CH)
Jar-5	33.3-35.3	Ditto	(CH)
Jar-6	35.3-37.3	wet, black & olive, ditto	(CH)
Jar-7	37.3-39.3	wet, black & olive, fat clay (tr. fine sand) (CH)	(CH)
Jar-8	39.3-41.3	Ditto	(CH)
Jar-9	41.3-43.3	Ditto	(CH)
Jar-10	43.3-45.3	Ditto	(CH)
		L. Fine sand	
	DH-6		
Jar-1	22.2-24.2	wet, black & olive gray, fat clay w/sand (CH)	(CH)
Jar-2	24.2-26.2	wet, black & ol. gray, fat clay (tr. fine sand) (CH)	(CH)
Jar-3	26.2-28.2	wet, blk. & rv. dk. gry. brown, ditto	(CH)
Jar-4	28.2-30.2	Ditto	(CH)
Jar-5	30.2-32.2	Ditto	(CH)
Jar-6	32.2-34.2	Ditto	(CH)
Jar-7	34.2-36.2	wet, blk & olive, ditto	(CH)
Jar-8	36.2-38.2	wet, blk. & ol. gray, ditto	(CH)
Jar-9	38.2-40.2	wet, blk. & olive, ditto	(CH)
Jar-10	40.2-42.2	wet, blk. & ol. gray, ditto	(CH)
Jar-11	42.2-44.2	wet, blk & olive, ditto	(CH)

VISUAL-MANUAL CLASSIFICATIONS

PROJECT: Tolchester Channel Realignment

DATE: Oct. 99

AREA: Kent County, MD

Classified by: Sharpe

Sample No.	Depth (ft.)	Visual Classification	Symbol
DH-7			
Jar-1	21.1- 23.1	wet, blk & ol. gray, fat clay (tr fine sand & shell fr.) (CH)	
Jar-2	23.1- 25.1	Ditto	(CH)
Jar-3	25.1- 27.1	Ditto (w/o shell frag.)	(CH)
Jar-4	27.1- 29.1	Ditto	(CH)
Jar-5	29.1- 31.1	Ditto	(CH)
Jar-6	31.1- 33.1	Ditto	(CH)
Jar-7	33.1- 35.1	wet, blk & olive, ditto	(CH)
Jar-8	35.1- 37.1	wet, blk & ol. gray, ditto	(CH)
Jar-9	37.1- 39.1	Ditto	(CH)
Jar-10	39.1- 41.1	Ditto	(CH)
Jar-11	41.1- 43.1	Ditto	(CH)
Jar-12	43.1- 45.1	Ditto	(CH)
DH-8			
^{very smal} Sample	25.8- 27.8	wet, blk, & ol. gray, fat clay (tr fine sand) (CH)	
Jar-1	25.8- 27.8		
Jar-2	27.8- 29.8	Ditto	(CH)
Jar-3	29.8- 31.8	Ditto	(CH)
Jar-4	31.8- 33.8	Ditto	(CH)
Jar-5	33.8- 35.8	Ditto	(CH)
Jar-6	35.8- 37.8	Ditto	(CH)
Jar-7	37.8- 39.8	Ditto	(CH)
Jar-8	39.8- 41.8	Ditto	(CH)
Jar-9	41.8- 43.8	Ditto	(CH)
Jar-10	43.8- 45.8	Ditto	(CH)

VISUAL-MANUAL CLASSIFICATIONS

PROJECT: Tolchester Channel Realignment

DATE: Oct. 99

AREA: Kent County, MD

Classified by: Sharpe

APPENDIX B

LABORATORY TEST RESULTS
&
GRAIN SIZE ANALYSIS

LABORATORY TEST RESULTS

PROJECT: Tolchester Channel Realignment

DATE: Nov. 1999

AREA: Kent County, MD

TEST: Specific Gravity, Water Contents, Organic Contents, Unit Weights

Sample ID	1	2	3	4	5
Hole No.	DH-1	DH-1	DH-2	DH-2	DH-3
Sample No.	Jar-1&2	Jar-4	Jar-1	Jar-5	Jar-6
Depth (ft)	32.3-36.3	38.3-40.3	29.6-31.6	37.6-39.6	36.5-38.5
Specific Gravity, G _s	2.65	2.58	2.62	2.67	2.64
Moisture Content, %	138.0	113.1	125.5	102.0	108.1
%L.O.L	8.3	12.0	8.4	11.0	9.1
Organic classification	Inorganic	Organic	Inorganic	Inorganic	Inorganic
In-situ Density (lb/ft ³) ¹	82.2	86.3	83.4	88.2	87.0
In-situ Density (lb/ft ³) ²	84.5	87.6	86.0	90.4	89.0

Sample ID	6	7	8	9	10
Hole No.	DH-3	DH-4	DH-4	DH-5	DH-5
Sample No.	Jar-10	Jar-1&2	Jar-9	Jar-3	Jar-8
Depth (ft)	44.5-46.5	25.1-29.1	41.1-43.1	29.3-31.3	39.3-41.3
Specific Gravity, G _s	2.66	2.62	2.65	2.59	2.69
Moisture Content, %	108.2	128.9	100.5	118.5	104.2
%L.O.L	9.0	8.5	7.3	11.9	7.1
Organic classification	Inorganic	Inorganic	Inorganic	Inorganic	Inorganic
In-situ Density (lb/ft ³) ¹	87.2	84.5	88.9	86.1	89.1
In-situ Density (lb/ft ³) ²	89.1	85.5	90.5	86.8	90.1

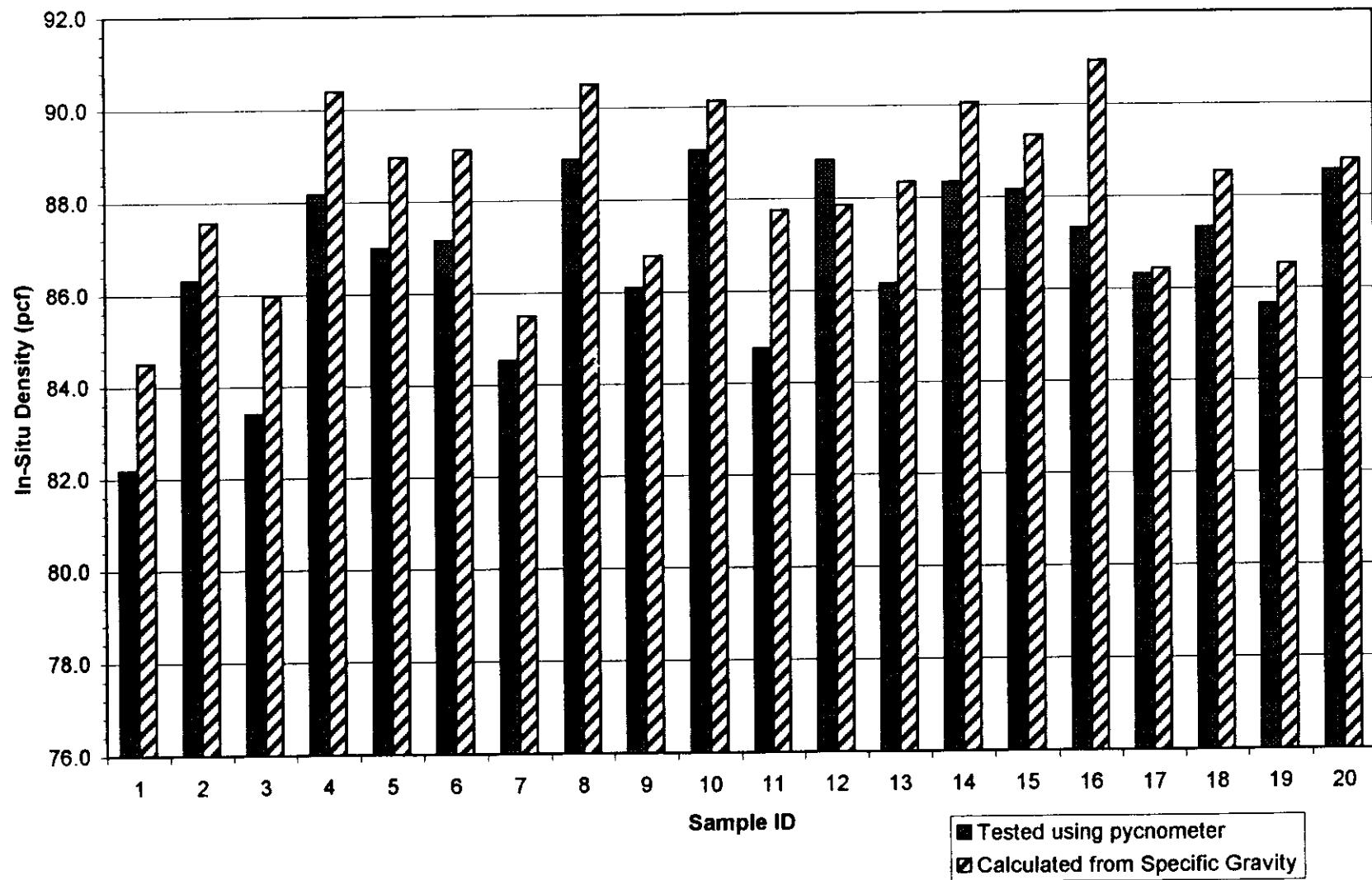
Sample ID	11	12	13	14	15
Hole No.	DH-6	DH-6	DH-7	DH-7	DH-8
Sample No.	Jar-3	Jar-11	Jar-3	Jar-6	Jar-4
Depth (ft)	26.2-28.2	42.2-44.2	25.1-27.1	31.1-33.1	31.8-33.8
Specific Gravity, G _s	2.54	2.67	2.56	2.69	2.65
Moisture Content, %	109.9	115.9	107.5	104.6	106.5
%L.O.L	14.0	7.1	14.2	8.8	11.4
Organic classification	Organic	Inorganic	Organic	Inorganic	Inorganic
In-situ Density (lb/ft ³) ¹	84.7	88.8	86.1	88.3	88.2
In-situ Density (lb/ft ³) ²	87.7	87.9	88.3	90.1	89.3

Sample ID	16	17	18	19	20
Hole No.	DH-8	DH-9	DH-9	DH-10	DH-10
Sample No.	Jar-9	Jar-2	Jar-6	Jar-3	Jar-5
Depth (ft)	41.8-43.8	35.3-37.3	43.3-45.3	40.1-42.1	44.1-46.1
Specific Gravity, G _s	2.69	2.63	2.59	2.62	2.61
Moisture Content, %	100.2	122.9	108.0	121.7	107.6
%L.O.L	6.7	10.6	14.0	10.7	11.0
Organic classification	Inorganic	Inorganic	Organic	Inorganic	Inorganic
In-situ Density (lb/ft ³) ¹	87.3	86.3	87.3	85.6	88.6
In-situ Density (lb/ft ³) ²	90.9	86.4	88.5	86.5	88.8

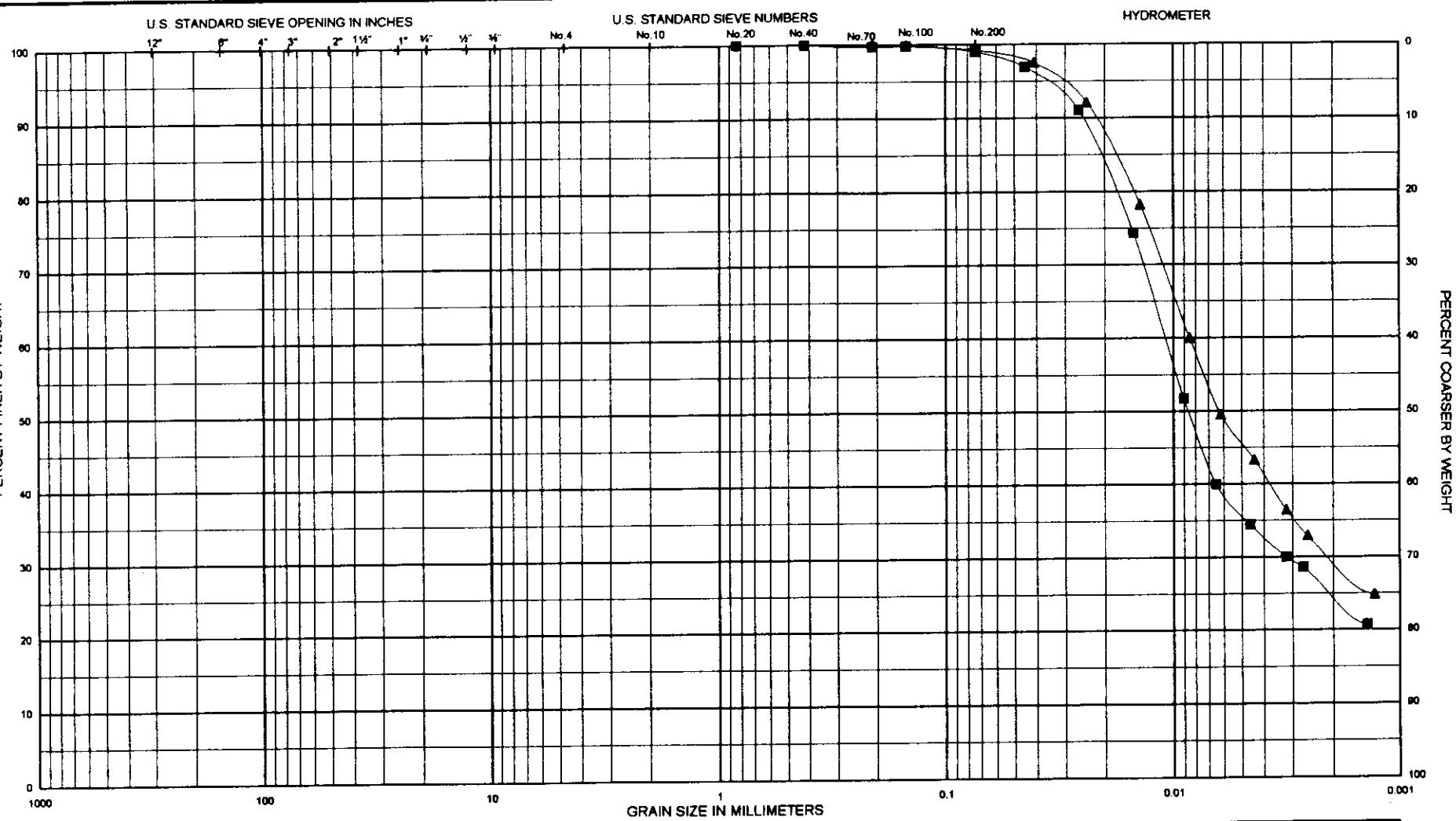
¹ These values were obtained using a pycnometer of known weight and volume.

² These values were calculated from the Specific Gravity assuming 100% saturation.

In-Situ Unit Weights

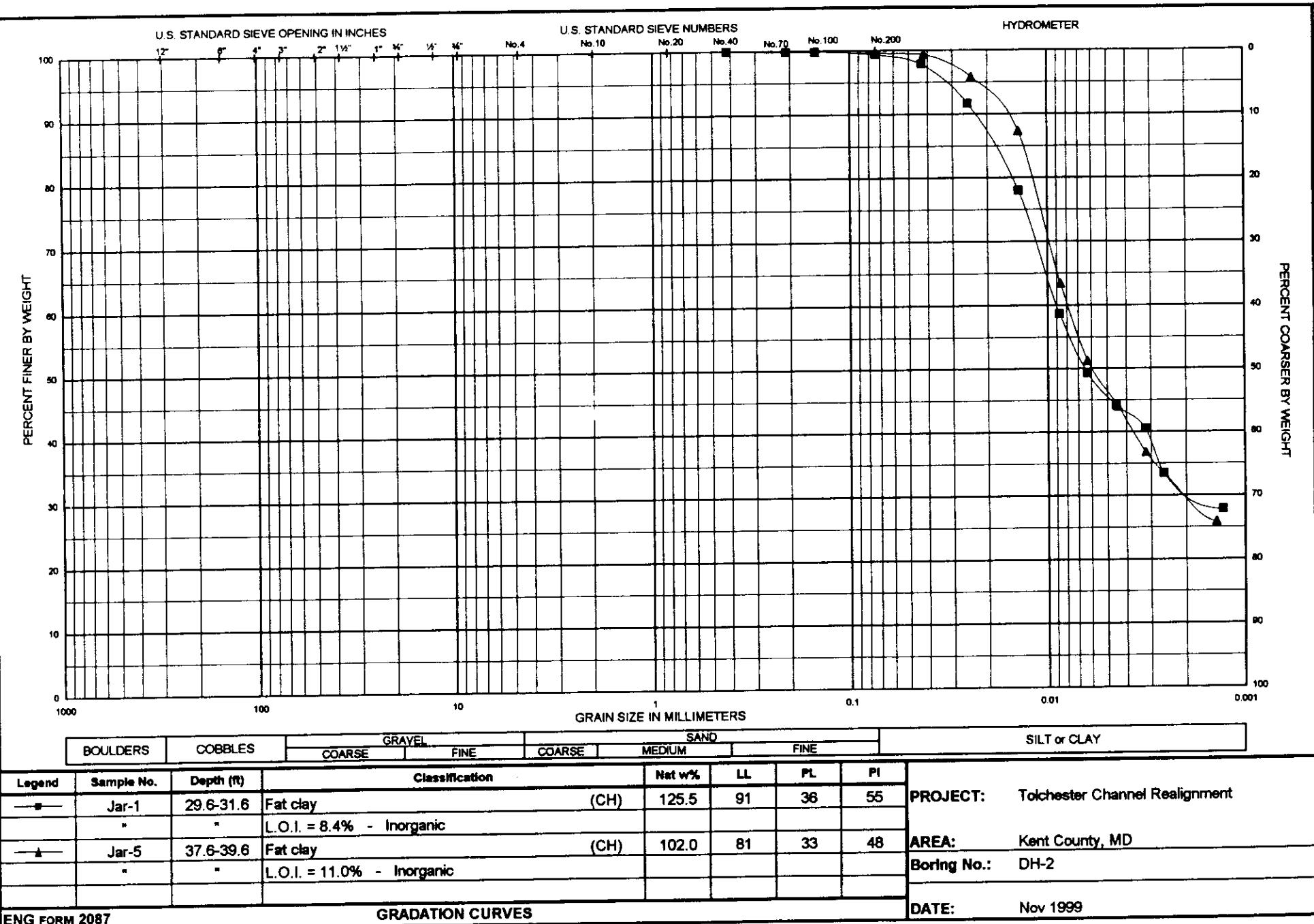


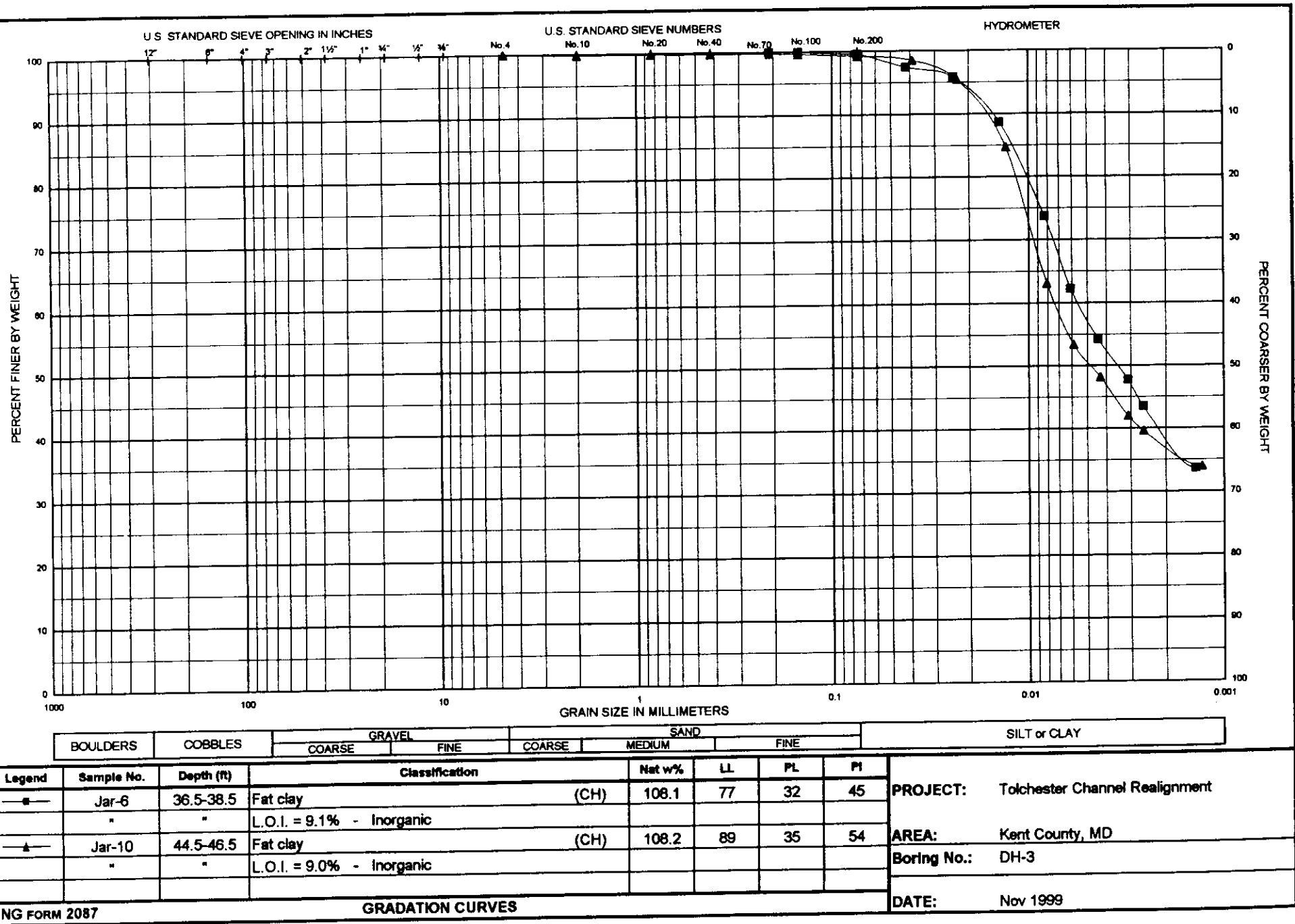
Tolchester Channel Realignment
Kent County, MD

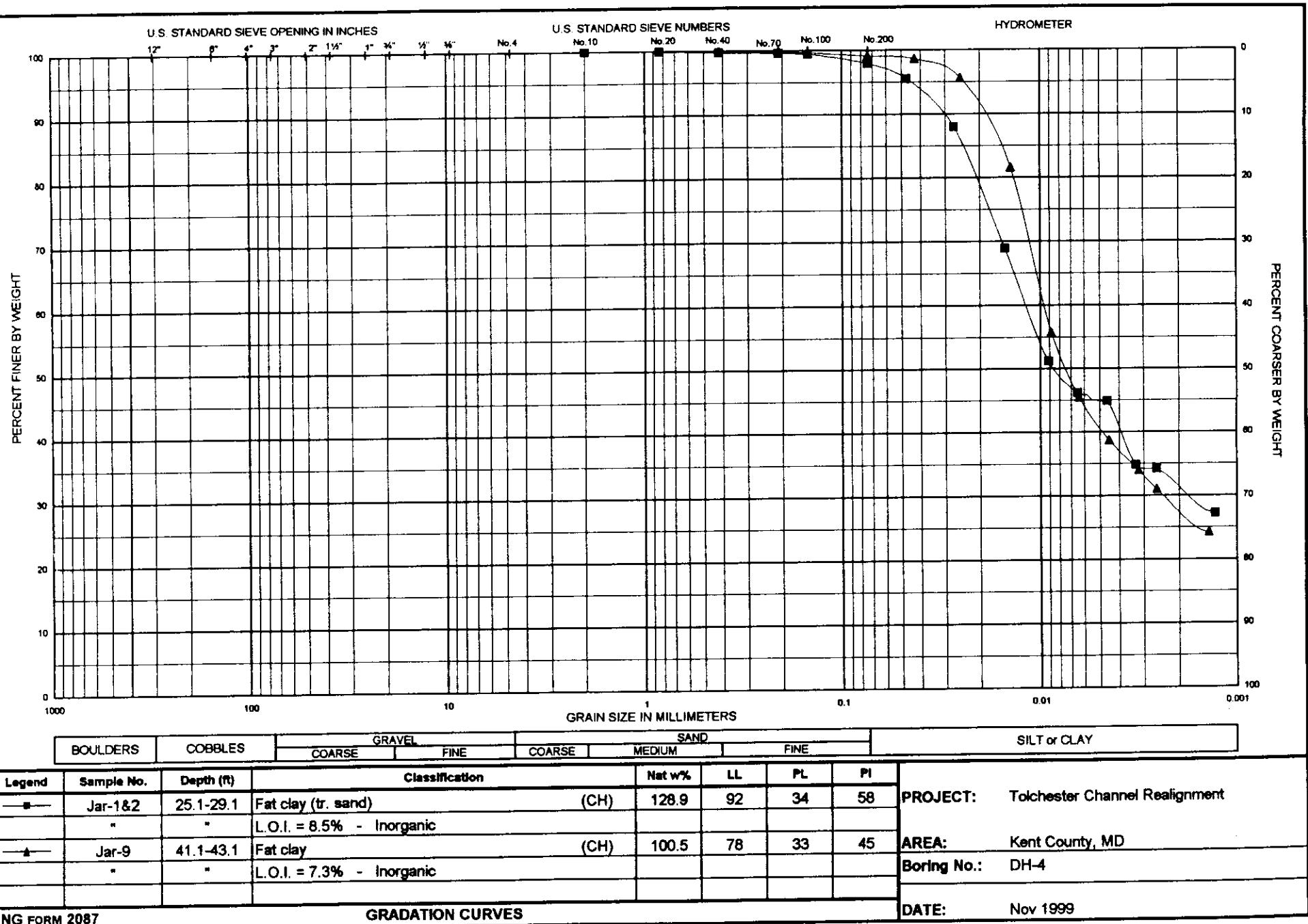


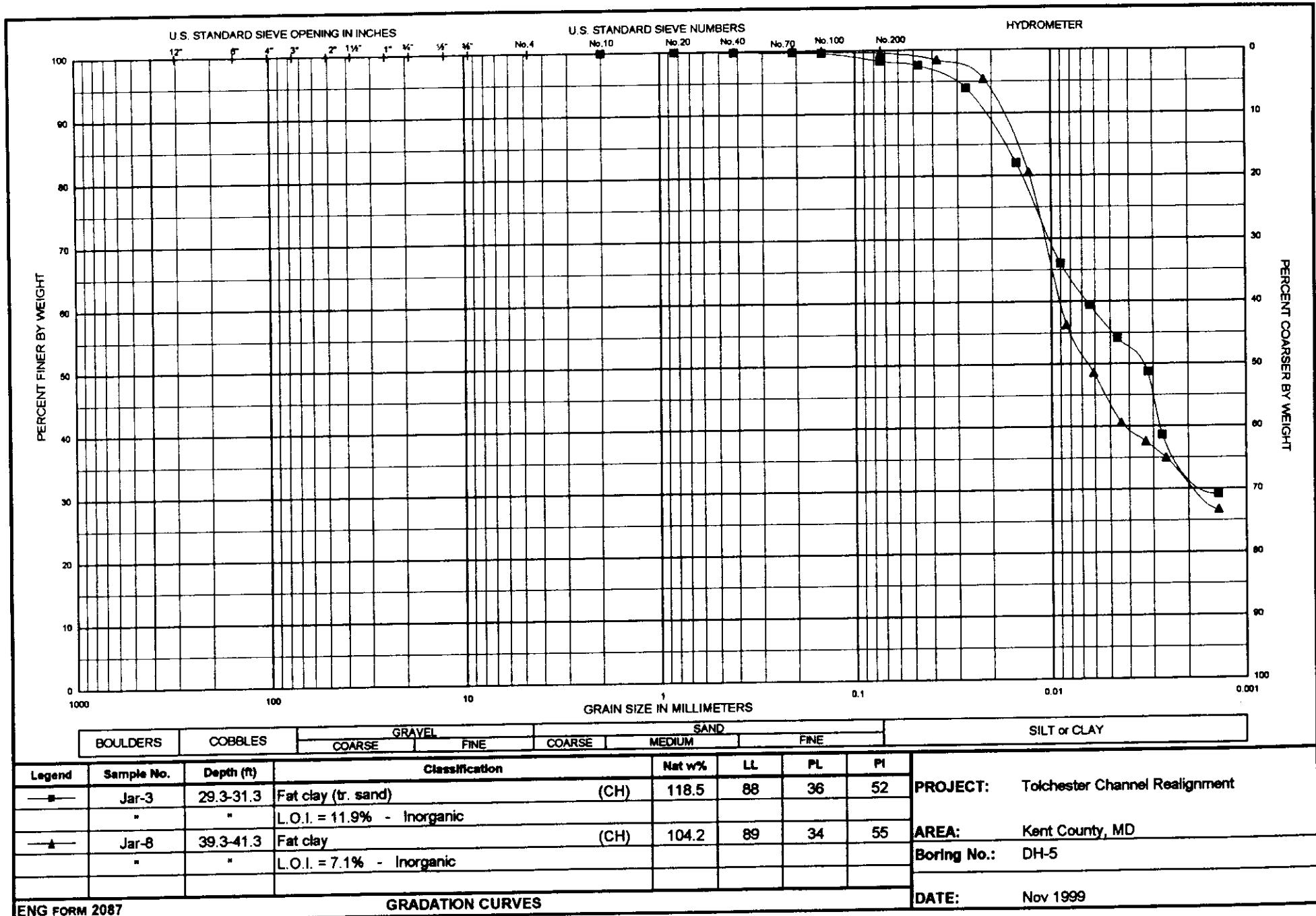
BOULDERS	COBBLES	GRAVEL		SAND			SILT or CLAY	
		COARSE	FINE	COARSE	MEDIUM	FINE		

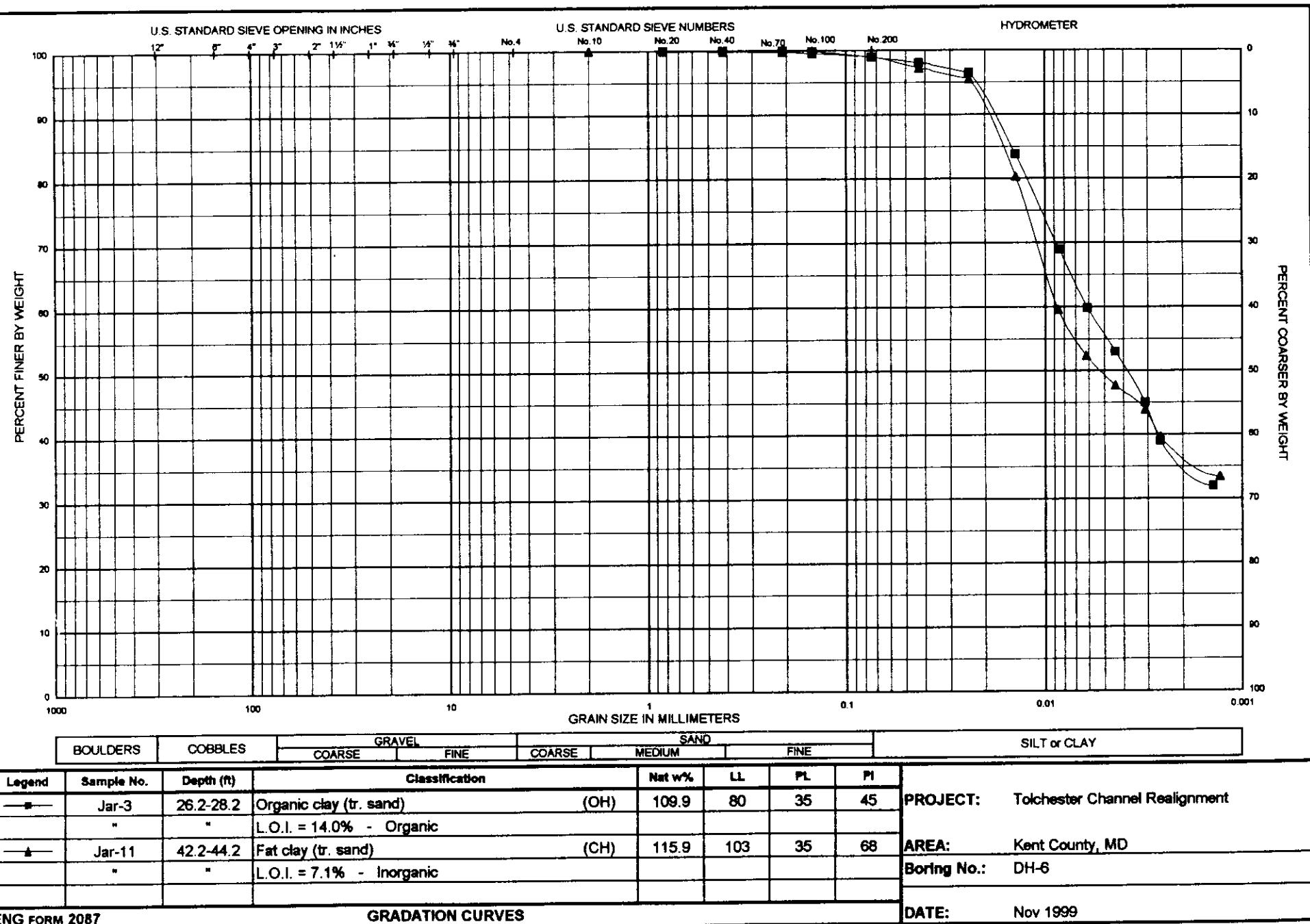
Legend	Sample No.	Depth (ft)	Classification		Net w%	LL	PL	PI	PROJECT:	Tolchester Channel Realignment
■	Jar-1&2	32.3-36.3	Fat clay (tr. sand)	(CH)	138.0	95	37	58	AREA:	Kent County, MD
	"	"	L.O.I. = 8.3% - Inorganic						Boring No.:	DH-1
▲	Jar-4	38.3-40.3	Organic clay	(OH)	113.1	81	36	45	DATE:	Nov 1999
	"	"	L.O.I. = 12.0% - Organic							

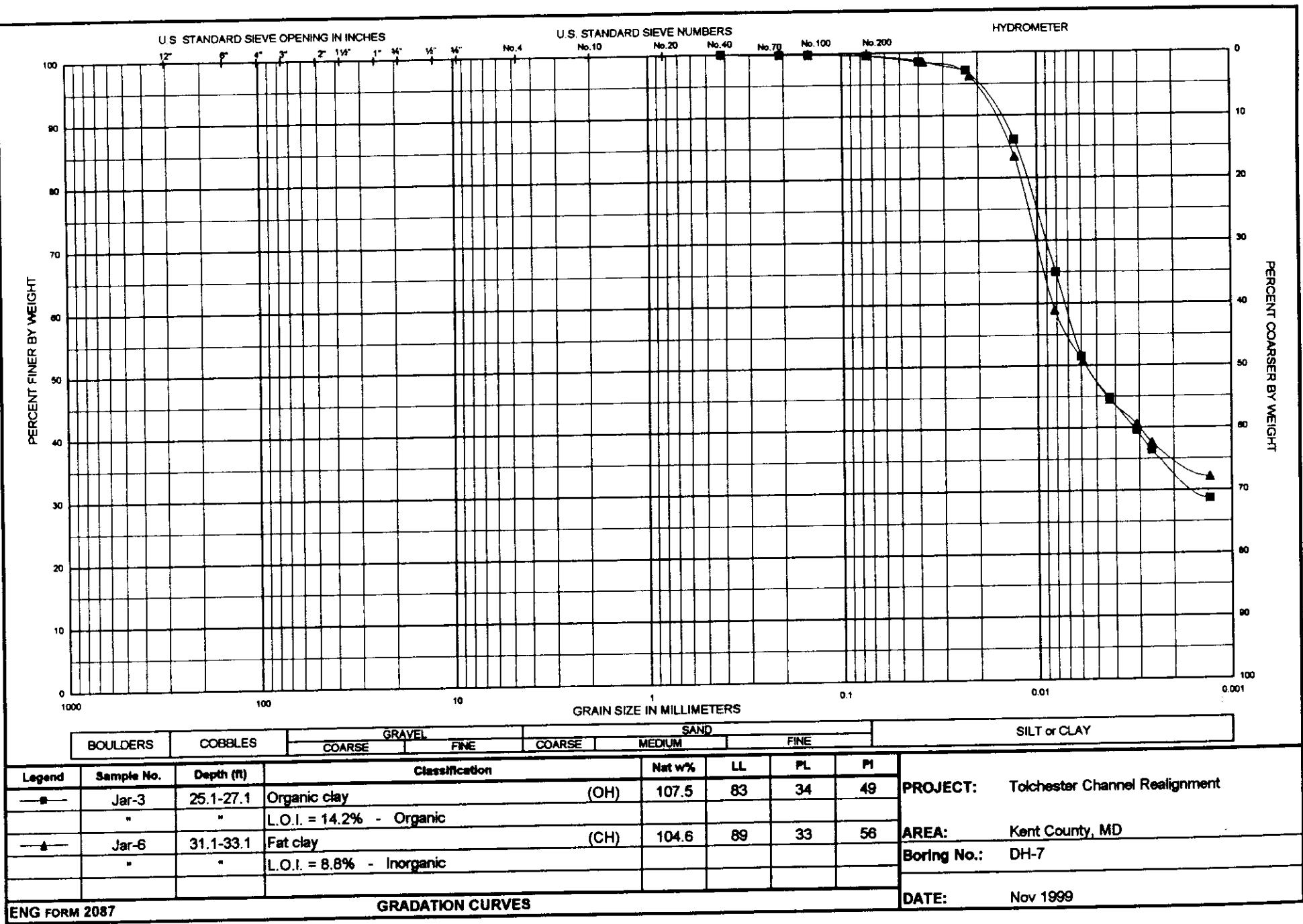


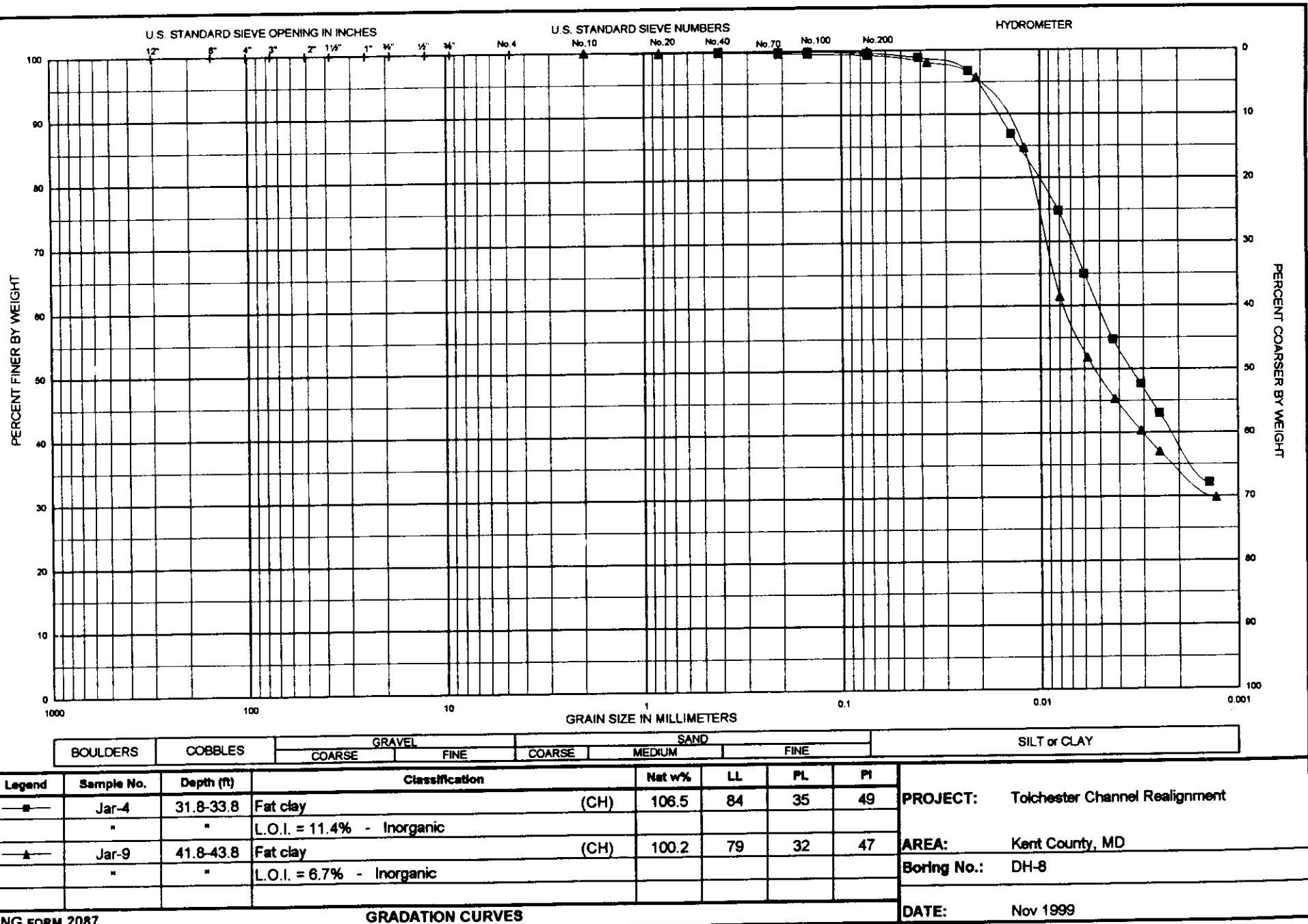


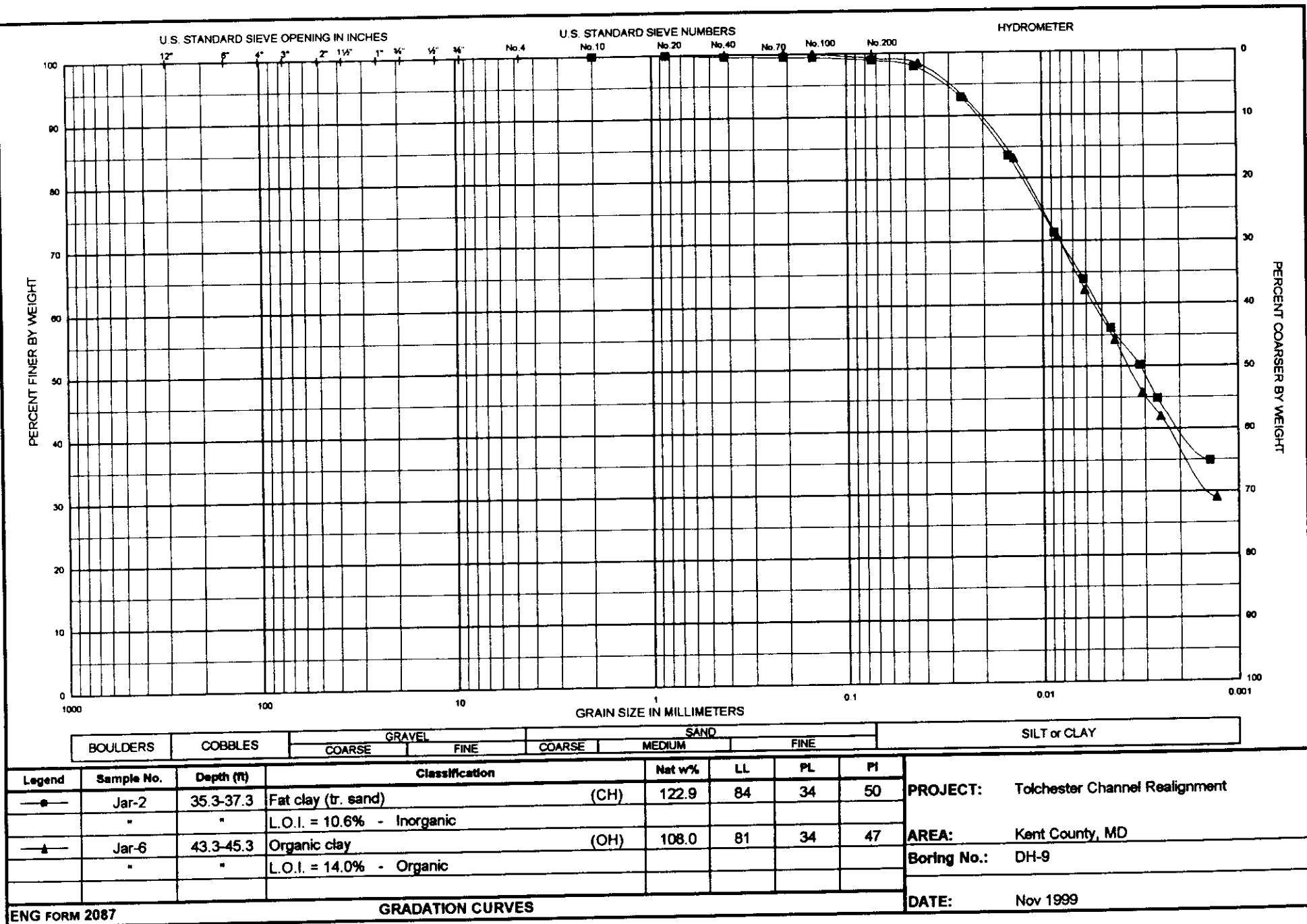


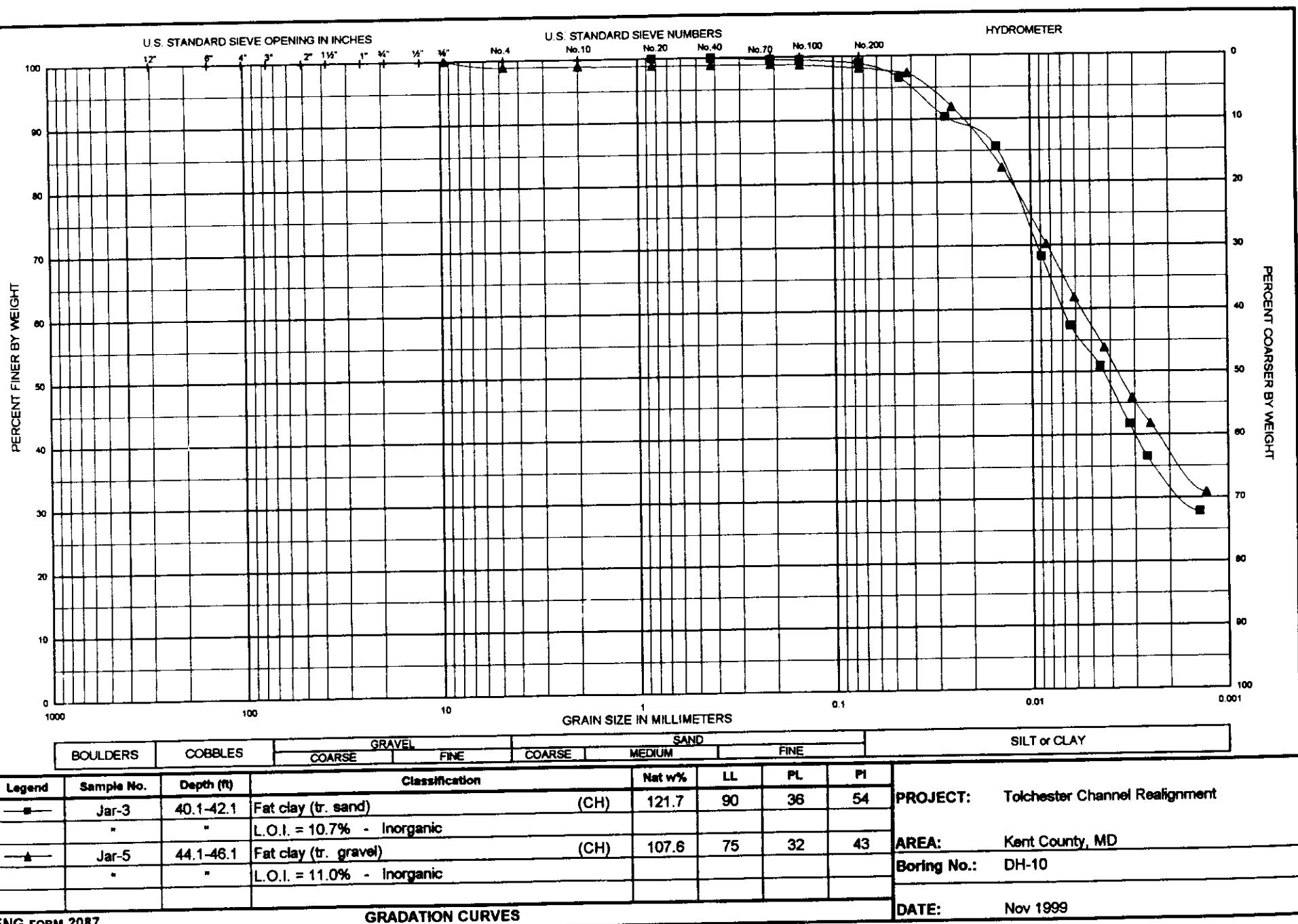












APPENDIX C
FINAL BORING LOGS

TOCHESTER CHANNEL REALIGNMENT
KENT COUNTY, MD.

SUBSURFACE EXPLORATION NOTES

1. EXPLORATION WAS PERFORMED DURING SEPTEMBER 1999.
2. EXPLORATION WAS ACCOMPLISHED USING A TRUCK MOUNTED ACKER AD II RIGGED ABOARD A BARGE. THESE HOLES WERE CONTINUOUSLY SAMPLED IN INCREMENTS OF 2.0' FOLLOWING SPT PROCEDURE GUIDELINES. SAMPLE SPOONS WERE ADVANCED BY WEIGHT OF ROD (WR) OR WEIGHT OF HAMMER (WH).
3. BLOW COUNTS REQUIRED TO ADVANCE SAMPLE SPOON ARE SHOWN IN COLUMN (a).
4. COLUMN (b) SHOWS THE NATURAL WATER CONTENTS IN PERCENT OF DRY WEIGHT OF THOSE SAMPLES TESTED.
5. SOIL DESCRIPTIONS ARE SHOWN IN COLUMN (c).
6. SOIL DESCRIPTIONS ARE LABORATORY CLASSIFICATIONS BASED ON THE UNIFIED SOIL CLASSIFICATION SYSTEM (ASTM D2487/2488).

THE ORGANIC TEST (ASTM D 2974, METHOD "C"; OR LOSS ON IGNITION TEST (LOI) (AASHTO-T-267) WAS USED TO EVALUATE AND DESCRIBE THE ORGANIC CONTENT OF SOILS FOR DESIGN AND CONSTRUCTION AS FOLLOWS:

LOI	SOIL DESCRIPTION
<12	INORGANIC
12 TO 24	ORGANIC
25 TO 60	VERY ORGANIC
>60	PEAT (Pt)

7. DEPTH OF BAY WATER SHOWN ON EACH BORING LOG WAS DETERMINED BY SOUNDING BAY WITH A WEIGHTED TAPE PRIOR TO START OF SAMPLING. CONCURRENT WITH DEPTH SOUNDING, TIDAL READINGS WERE OBTAINED FROM NOAA'S AUTOMATIC GAUGE AT FT. MCHENRY, BALTIMORE, MD.
8. ELEVATIONS(MLLW) SHOWN ON BORING LOGS ARE BOTTOM OF BAY CHANNEL FLOOR AT TIME OF EXPLORATION. THEY WERE DETERMINED BY ADJUSTMENT TO DEPTH SOUNDINGS IN ACCORDANCE WITH TIDAL READINGS.
9. BORINGS WERE LOCATED BY COE SURVEYORS, USING A STARLINK DNAV-212G GPS SYSTEM. THIS SYSTEM PROVIDES BETTER THAN 1 METER HORIZONTAL ACCURACY VERTICAL DATUM: NAVD 88(NORTH AMERICAN VERTICAL DATUM) M.L.L.W., FOR THE '60 TO '78 TIDAL EPOCH. HORIZONTAL DATUM: NORTH AMERICAN 1983 DATUM, MARYLAND STATE PLANE COORDINATE SYSTEM.

STA.
OFFSET:
TOP ELEV: 0.0

TOLCHESTER CHANNEL REALIGNMENT
KENT COUNTY, MD.

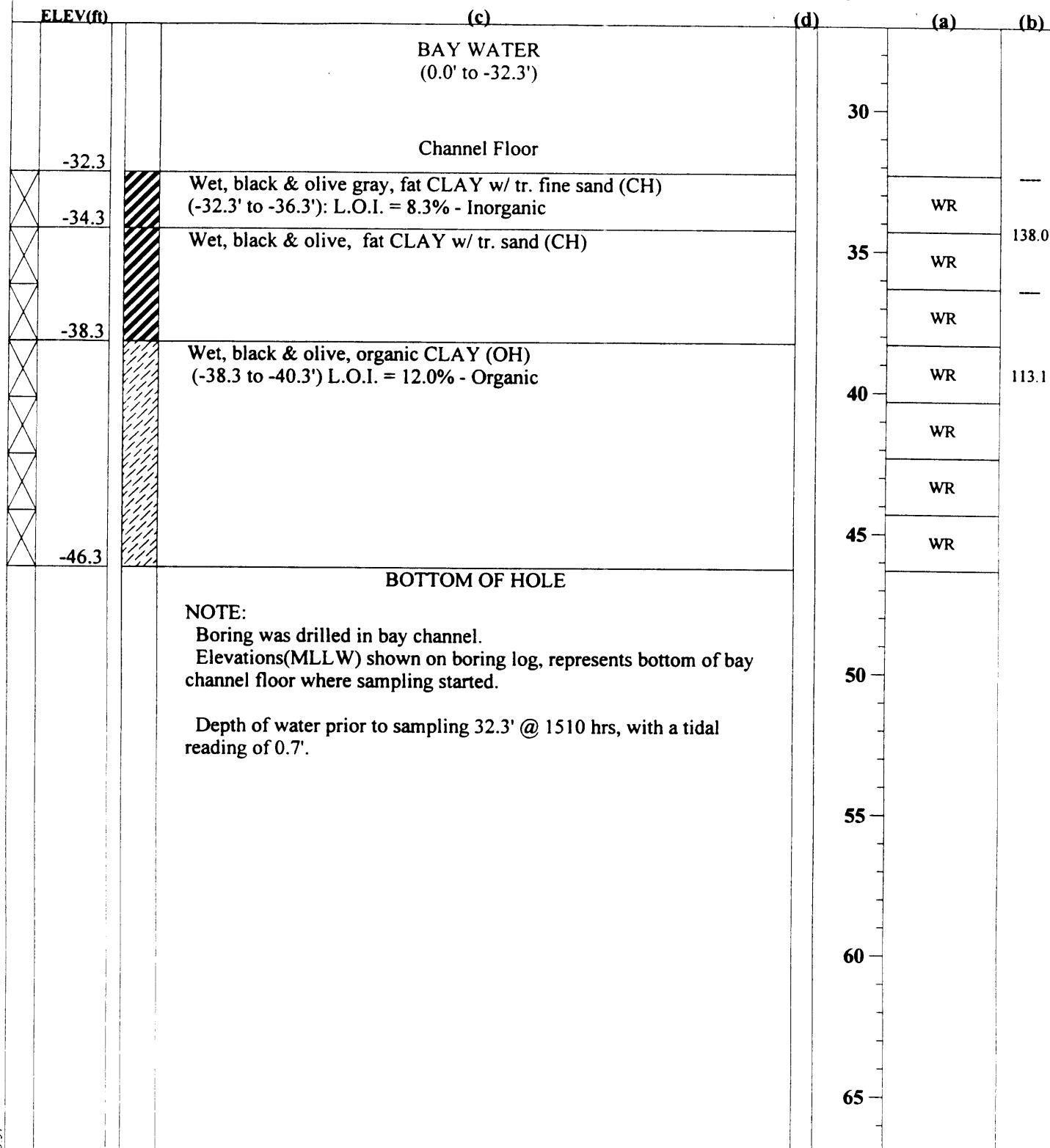
N 556673.8

E 1518699.1

COMPLETED: September 28, 1999

DH-1

1 of 1



DH-1
GROUNDWATER DATA
 WHILE DRILLING:
 ON COMPLETION:
 Hr. READING:

STA.
OFFSET:
TOP ELEV: 0.0

**TOLCHESTER CHANNEL REALIGNMENT
KENT COUNTY, MD.**

N 557238.1

E 1519552.6

DH-2

1 of 1

COMPLETED: September 28, 1999

ELEV(ft)	(c)	(d)	(a)	(b)
	BAY WATER (0.0' to -29.6')			
-29.6	Channel Floor			
-31.6	Wet, black & olive gray, fat CLAY w/ tr. fine sand (CH) L.O.I. = 8.4% - Inorganic		WR	125.5
	Wet, black & olive, fat CLAY w/ tr. fine sand (CH)		WR	
	(-33.6'- to -35.6') w/ shells		WR	
	(-37.6' to -39.6') L.O.I. = 11.0% - Inorganic		WR	
-41.6	Wet, black & olive gray, fat CLAY w/ tr. fine sand (CH)		WR	102.0
-43.6	Wet, black & olive, fat CLAY w/ tr. fine sand (CH)		WR	
-45.6			WH	
	BOTTOM OF HOLE			
<p>NOTE: Boring was drilled in bay channel. Elevations(MLLW) shown on boring log, represents bottom of bay channel floor where sampling started.</p> <p>Depth of water prior to sampling 29.6' @ 1620 hrs, with a tidal reading of 0.8'.</p>				
			25	
			30	WR
			35	WR
			40	WR
			45	WR
			50	
			55	
			60	

DH-2 GROUNDWATER DATA

- ☛ WHILE DRILLING:
- ☛ ON COMPLETION:
- ☛ Hr. READING:

▼ Hr. READING:



Fill



Auger SPT



RE



Cored

STA.
OFFSET:
TOP ELEV: 0.0

TOLCHESTER CHANNEL REALIGNMENT
KENT COUNTY, MD.

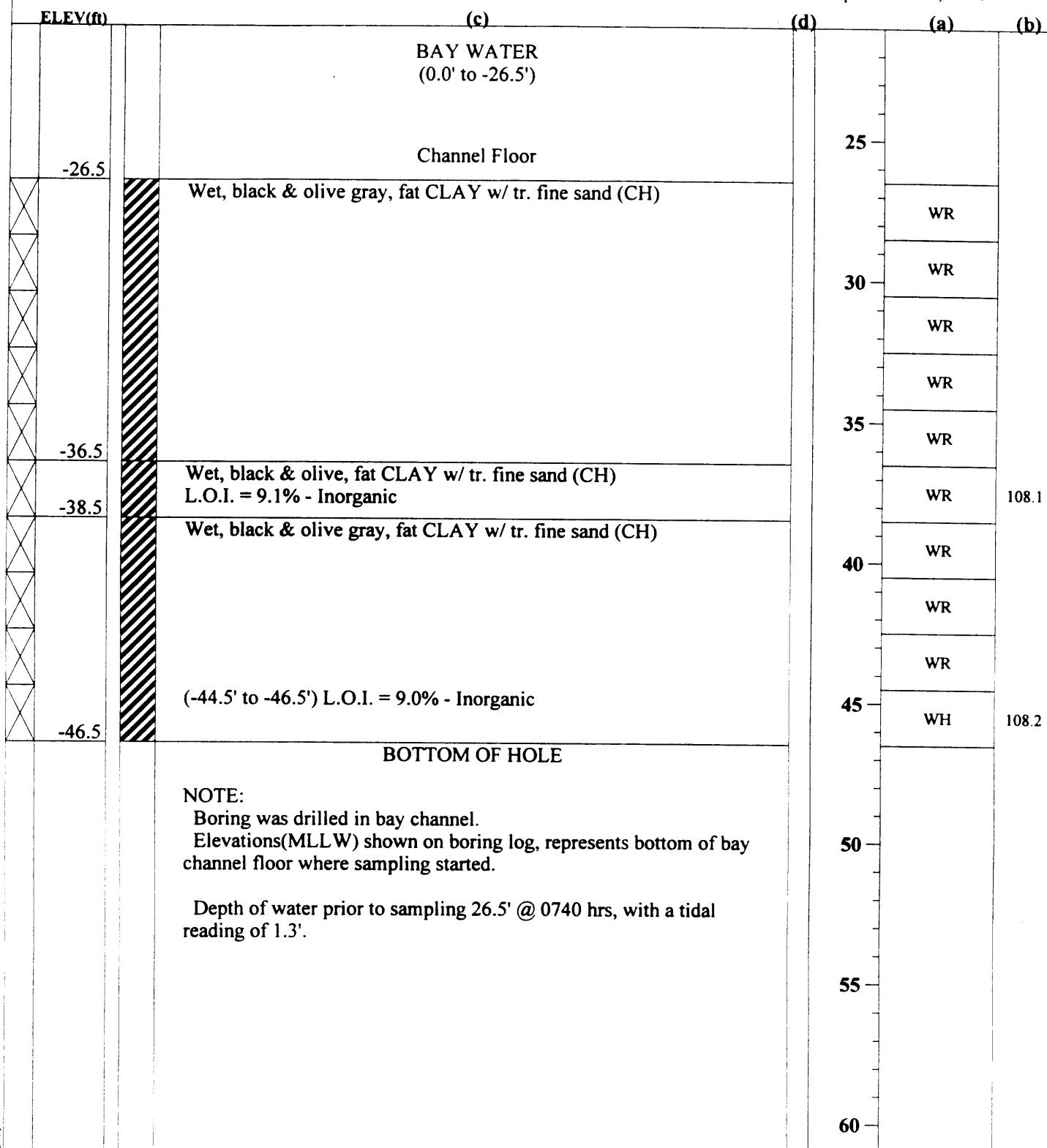
N 558187.2

E 1519961.1

COMPLETED: September 29, 1999

DH-3

1 of 1



GEO-2 TOLCH01 GPJ 12/29/99 1341

DH-3
GROUNDWATER DATA
 WHILE DRILLING:
 ON COMPLETION:
 Hr. READING:

 Fill  Auger  SPT  RB  Cored

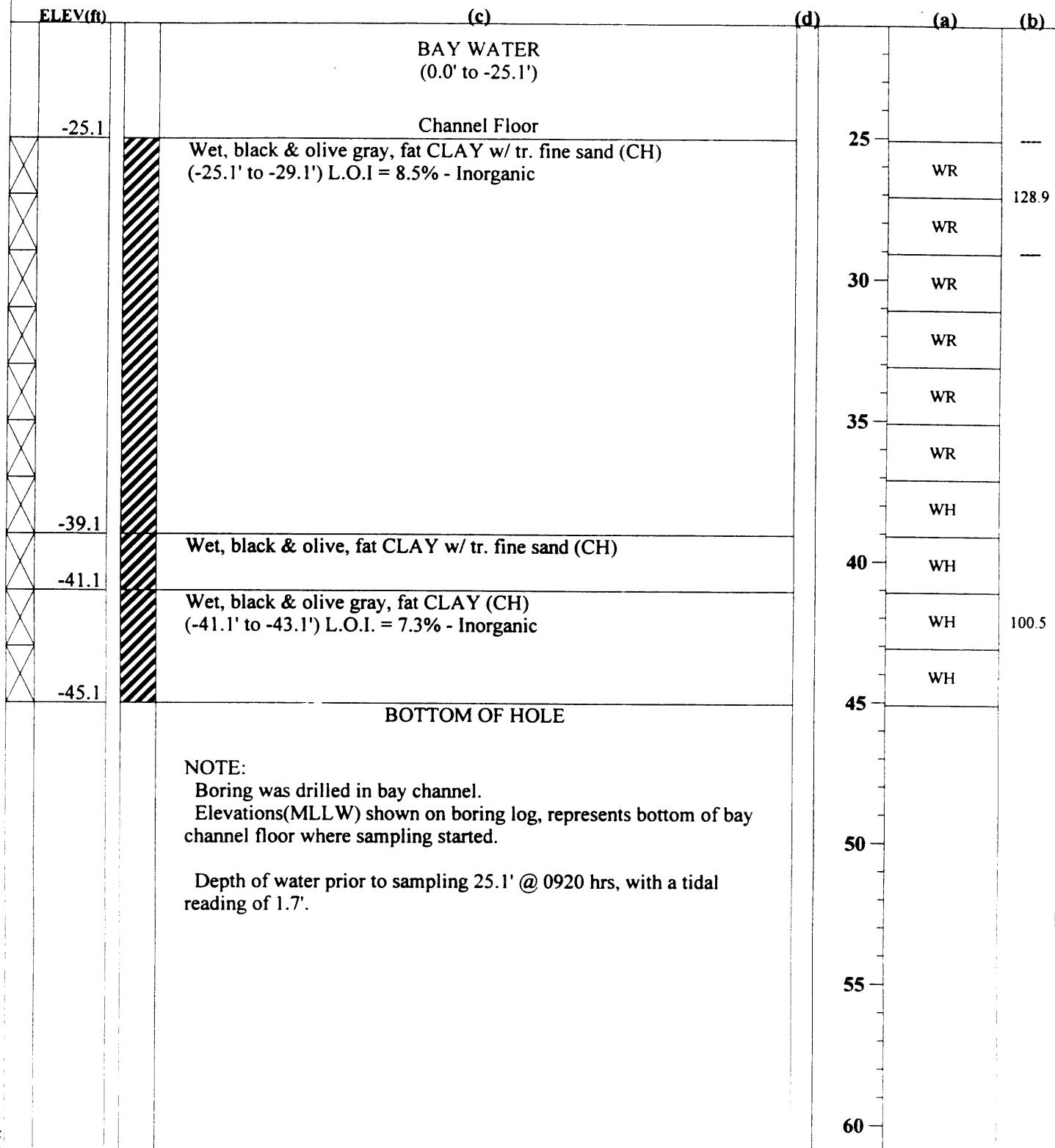
STA.
OFFSET:
TOP ELEV: 0.0

TOLCHESTER CHANNEL REALIGNMENT
KENT COUNTY, MD.

N 558781.1
E 1520852.8
COMPLETED: September 29, 1999

DH-4

1 of 1



GEO-2 TOH (H01 GP) 12/29/99 13:41

DH-4
GROUNDWATER DATA

- WHILE DRILLING:
 ON COMPLETION:
 Hr. READING:

Fill Auger SPT RB Cored

STA.
OFFSET:
TOP ELEV: 0.0

TOLCHESTER CHANNEL REALIGNMENT
KENT COUNTY, MD.

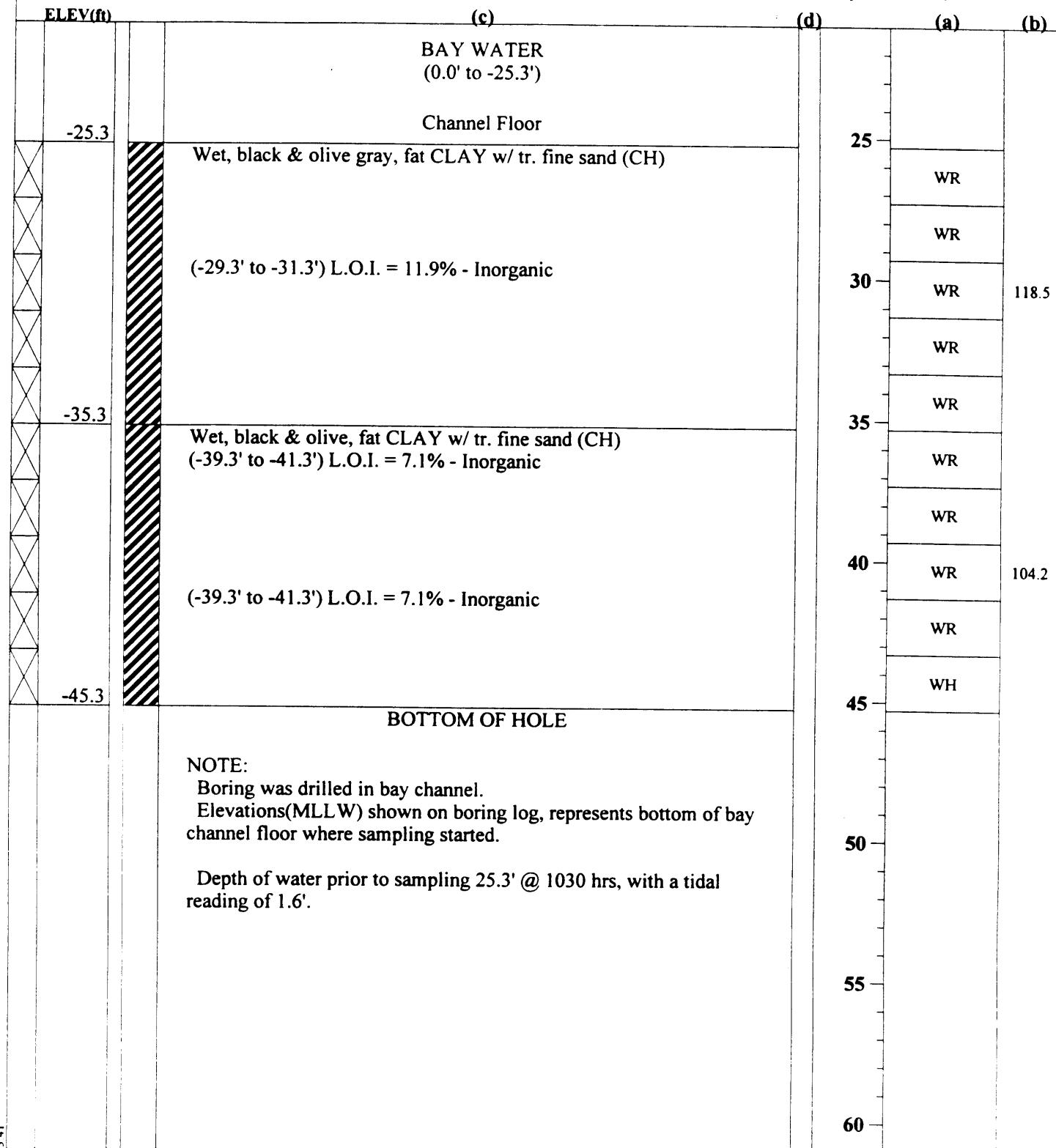
N 559725.7

E 1521307.0

COMPLETED: September 29, 1999

DH-5

1 of 1



GEO-2 TOLCH01.GPJ 12/29/99

13.41
DH-5
GROUNDWATER DATA
+ WHILE DRILLING:
☒ ON COMPLETION:
☒ Hr. READING:

Fill Auger SPT RB Cored

STA.
OFFSET:
TOP ELEV: 0.0

TOLCHESTER CHANNEL REALIGNMENT
KENT COUNTY, MD.

N 560300.3

E 1522183.0

COMPLETED: September 29, 1999

DH-6

1 of 1

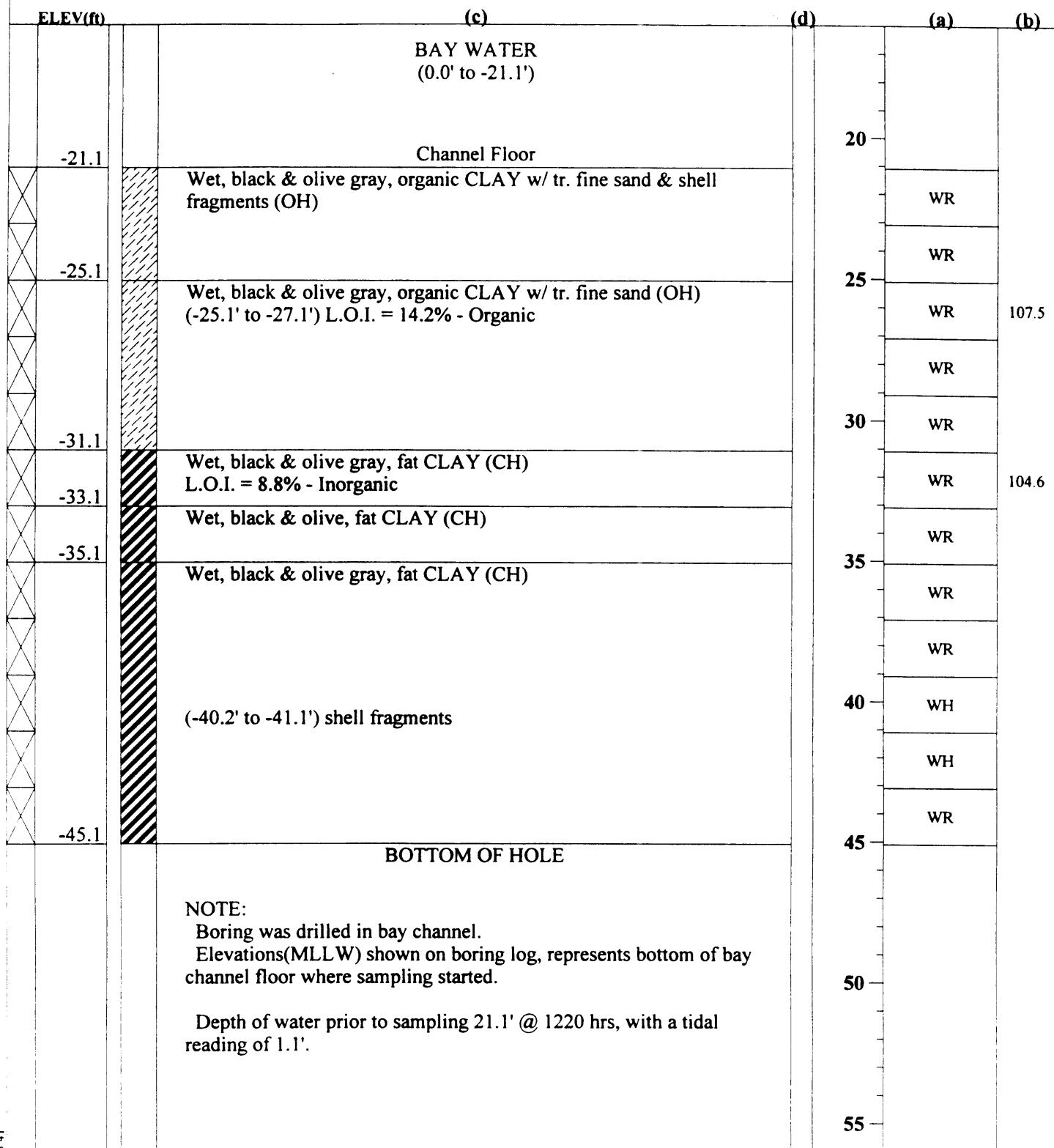
ELEV(ft)	(c)	(d)	(a)	(b)
	BAY WATER (0.0' to -22.2')			
-22.2	Channel Floor			20
-24.2	Wet, black & olive gray, fat CLAY w/ sand (CH)		WR	25
-26.2	Wet, black & olive gray, organic CLAY w/ tr. fine sand (OH)		WR	109.9
	Wet, black & very dk. grayish brown, organic CLAY w/ tr. fine sand (OH) (-26.2' to -28.2') L.O.I. = 14.0% - Organic		WR	30
-34.2	Wet, black & olive, organic CLAY w/ tr. fine sand (OH)		WR	35
-36.2	Wet, black & olive gray, organic CLAY w/ tr. fine sand (OH)		WR	40
-38.2	Wet, black & olive, organic CLAY w/ tr. fine sand (OH)		WR	45
-40.2	Wet, black & olive gray, organic CLAY w/ tr. fine sand (OH)		WR	50
-42.2	Wet, black & olive gray, fat CLAY w/ tr. fine sand (CH) L.O.I. = 7.1% - Inorganic		WH	115.9
-44.2	BOTTOM OF HOLE			55
	NOTE: Boring was drilled in bay channel. Elevations(MLLW) shown on boring log, represents bottom of bay channel floor where sampling started. Depth of water prior to sampling 22.2' @ 1110hrs, with a tidal reading of 1.6'.			

STA.
OFFSET:
TOP ELEV: 0.0

TOLCHESTER CHANNEL REALIGNMENT
KENT COUNTY, MD.

N 561219.7
E 1522649.1
COMPLETED: September 29, 1999

DH-7
1 of 1



NOTE:

Boring was drilled in bay channel.

Elevations(MLLW) shown on boring log, represents bottom of bay channel floor where sampling started.

Depth of water prior to sampling 21.1' @ 1220 hrs, with a tidal reading of 1.1'.

DH-7
GROUNDWATER DATA

WHILE DRILLING:

ON COMPLETION:

Hr. READING:

STA.
OFFSET:
TOP ELEV: 0.0

TOLCHESTER CHANNEL REALIGNMENT
KENT COUNTY, MD.

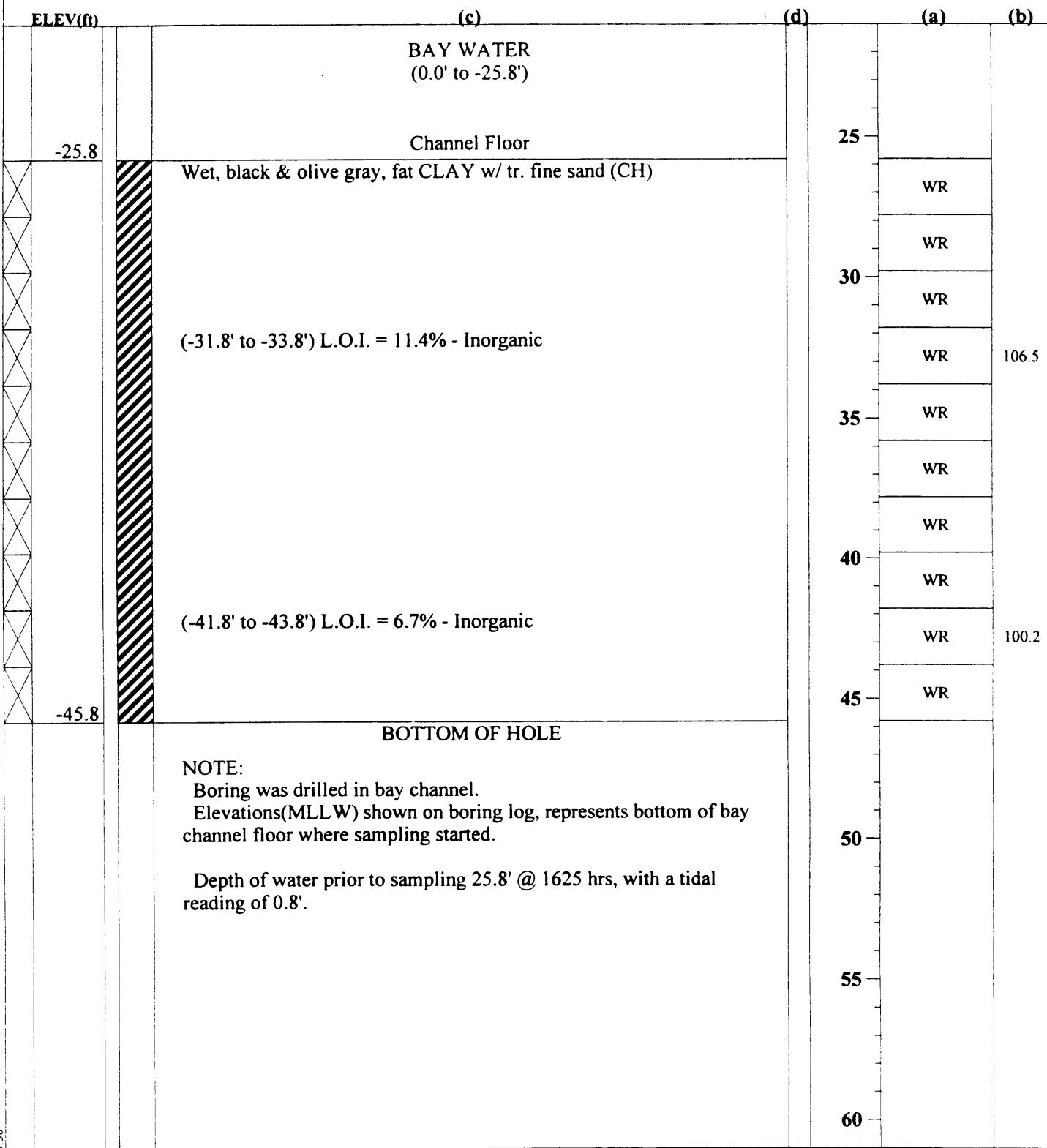
N 561767.3

E 1523464.2

COMPLETED: September 29, 1999

DH-8

1 of 1



GEO-2 TOLCH01 GPJ 12/29/99 13 50

DH-8
GROUNDWATER DATA
 WHILE DRILLING:
 ON COMPLETION:
 Hr. READING:

Fill Auger SPT RB Cored

STA.
OFFSET:
TOP ELEV: 0.0

TOLCHESTER CHANNEL REALIGNMENT KENT COUNTY, MD.

N 563387.3

E 1524118.7

COMPLETED: October 1, 1999

DH-9

1 of 1

ELEV(ft)	(c)	(d)	(a)	(b)
	BAY WATER (0.0' to -33.3')			
-33.3	Channel Floor			
-35.3	Wet, black & olive gray, fat CLAY w/ tr. fine sand (CH)			
-37.3	Wet, very dk. gray & olive gray, fat CLAY w/ tr. fine sand (CH) L.O.I = 10.6% - Inorganic			122.9
-41.3	Wet, black & olive, fat CLAY w/ tr. fine sand (CH)			
-43.3	Wet, black & olive gray, fat CLAY w/ tr. fine sand (CH)			
-45.3	Wet, black & olive, organic CLAY (OH) L.O.I. = 14.0% - Organic			108.0
	BOTTOM OF HOLE			
	NOTE: Boring was drilled in bay channel. Elevations(MLLW) shown on boring log, represents bottom of bay channel floor where sampling started.			
	Depth of water prior to sampling 33.3' @ 0830 hrs, with a tidal reading of 0.7'.			
			30	
			35	WR
			40	WR
			45	WR
			50	
			55	
			60	
			65	

DH-9

GROUNDWATER DATA

- WHILE DRILLING:**
ON COMPLETION:
Hr. READING:



Fill



Auger



SPT



RB



1 Cored

STA.
OFFSET:
TOP ELEV: 0.0

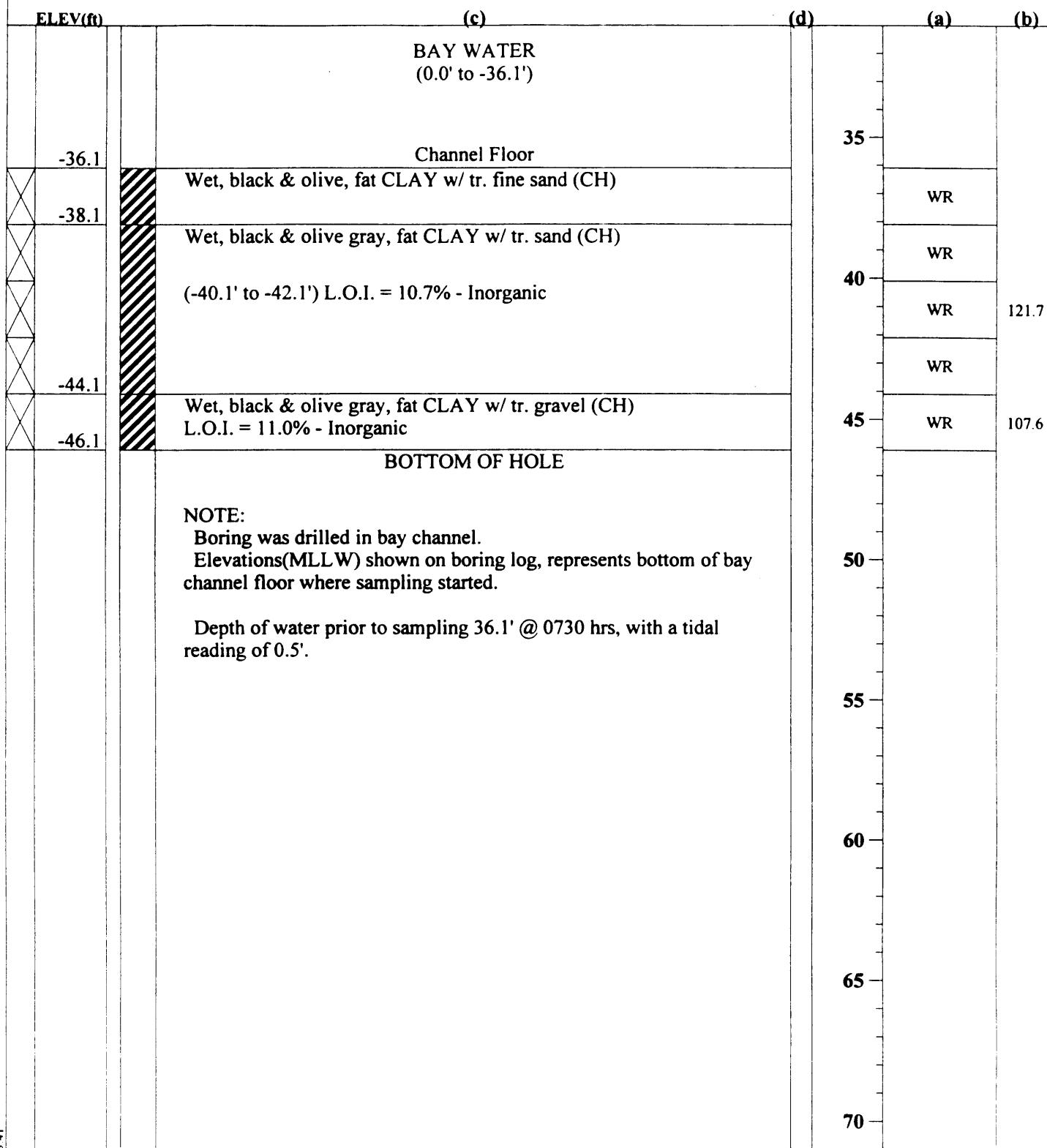
TOLCHESTER CHANNEL REALIGNMENT
KENT COUNTY, MD.

N 562576.3

E 1524032.5

COMPLETED: October 1, 1999

DH-10
1 of 1



DH-10
GROUNDWATER DATA

WHILE DRILLING:

ON COMPLETION:

Hr. READING:

APPENDIX D
INDEX CALCULATIONS

SUBJECT Tolchester Channel S-Turn Subsurface InvestigationCOMPUTATIONS Plastic Index, Liquidity Index, Activity Index SHEET 1 OF 1 SHEETSCOMPUTED BY MAS CHECKED BY _____ DATE 12/29/99

a) Plastic Indexes are calculated from the formula:

$$PI = LL - PL$$

where:

PI = Plastic Index

LL = Liquid Limit

PL = Plastic Limit

b) Liquidity Indexes are calculated from the formula:

$$LI = (W - PL) / (LL - PL) \text{ or}$$

$$LI = (W - PL) / PI$$

where:

LI = Liquidity Index

PI = Plastic Index

W = Water Content

LL = Liquid Limit

PL = Plastic Limit

c) Activity Indexes are calculated from the formula:

$$AI = PI / (\% - 0.002 \text{ mm})$$

where:

AI = Activity Index

PI = Plastic Index

 $\% - 0.002 \text{ mm} =$ percent clay finer than the 0.002 mm screen

Source: Geotechnical Factors of Dredgability of Sediments: Geotechnical Site Investigation Strategy for Dredge Projects
WES, S. Joseph Spigolon, pg. 24-25

SUBJECT To/chester Channel S-Turn Subsurface InvestigationCOMPUTATIONS Plastic Index, Liquidity Index, Activity Index SHEET 2 OF 1 SHEETSCOMPUTED BY MAB CHECKED BY _____ DATE 12/29/99Laboratory Test Results

Boring & Sample	Water Content	Liquid Limit	Plastic Limit	% - 0.002 mm
DH-1 Jar 1	138.0%	95	37	24%
DH-1 Jar 4	113.1%	81	36	29%
DH-2 Jar 1	125.5%	91	36	29%
DH-2 Jar 5	102.0%	81	33	29%
DH-3 Jar 6	108.1%	77	32	37%
DH-4 Jar 2	128.9%	92	34	32%
DH-4 Jar 9	100.5%	78	33	27%
DH-5 Jar 3	118.5%	88	36	30%
DH-5 Jar 8	104.2%	89	34	30%
DH-6 Jar 3	109.9%	80	35	35%
DH-6 Jar 11	115.9%	103	35	35%
DH-7 Jar 3	107.5%	83	34	32%
DH-7 Jar 6	104.6%	89	33	35%
DH-8 Jar 4	106.5%	84	35	38%
DH-8 Jar 9	100.2%	79	32	34%
DH-9 Jar 2	122.9%	84	34	40%
DH-9 Jar 6	108.0%	81	34	36%
DH-10 Jar 3	121.7%	90	36	31%
DH-10 Jar 5	107.6%	75	32	36%

Plastic Index (P.I.)

DH-1 Jar 1	$PI = 95 - 37 = 58$	P.I. = 58
DH-1 Jar 4	$PI = 81 - 36 = 45$	P.I. = 45
DH-2 Jar 1	$PI = 91 - 36 = 55$	P.I. = 55
DH-2 Jar 5	$PI = 81 - 33 = 48$	P.I. = 48
DH-3 Jar 6	$PI = 77 - 32 = 45$	P.I. = 45
DH-3 Jar 10	$PI = 89 - 35 = 54$	P.I. = 54
DH-4 Jar 2	$PI = 92 - 34 = 58$	P.I. = 58
DH-4 Jar 9	$PI = 78 - 33 = 45$	P.I. = 45
DH-5 Jar 3	$PI = 88 - 36 = 52$	P.I. = 52
DH-5 Jar 8	$PI = 89 - 34 = 55$	P.I. = 55
DH-6 Jar 3	$PI = 80 - 35 = 45$	P.I. = 45
DH-6 Jar 11	$PI = 103 - 35 = 68$	P.I. = 68
DH-7 Jar 3	$PI = 83 - 34 = 49$	P.I. = 49

SUBJECT Tolchester Channel S-Turn Subsurface InvestigationCOMPUTATIONS Plastic Index, Liquidity Index, Activity Index SHEET 3 OF _____ SHEETSCOMPUTED BY MJO

CHECKED BY _____

DATE 12/29/99Plastic Index (P.I.)DH-7 Jar 6 PI = $89.33 - 56 = 56$ P.I. = 56DH-8 Jar 4 PI = $84.35 - 49 = 49$ P.I. = 49DH-8 Jar 9 PI = $79.32 - 47 = 47$ P.I. = 47DH-9 Jar 2 PI = $84.34 - 50 = 50$ P.I. = 50DH-9 Jar 6 PI = $81.34 - 47 = 47$ P.I. = 47DH-10 Jar 3 PI = $90.36 - 54 = 54$ P.I. = 54DH-10 Jar 5 PI = $75.32 - 43 = 43$ P.I. = 43

Average = 51 Standard Deviation = 6.27

Liquidity Index (L.I.)DH-7 Jar 2 LI = $(130.37) / 59 = 1.74$ DH-7 Jar 4 LI = $(113.1-36) / 45 = 1.31$ DH-2 Jar 2 LI = $(125.5-36) / 55 = 1.63$ DH-2 Jar 5 LI = $(102.0-33) / 48 = 1.44$ DH-3 Jar 6 LI = $(108.1-32) / 45 = 1.69$ DH-3 Jar 10 LI = $(108.2-35) / 54 = 1.36$ DH-4 Jar 2 LI = $(120.9-34) / 58 = 1.64$ DH-4 Jar 9 LI = $(100.5-33) / 45 = 1.50$ DH-5 Jar 3 LI = $(118.5-36) / 52 = 1.59$ DH-5 Jar 8 LI = $(104.2-34) / 55 = 1.20$ DH-6 Jar 3 LI = $(109.9-35) / 45 = 1.66$ DH-6 Jar 11 LI = $(115.9-36) / 60 = 1.19$ DH-7 Jar 3 LI = $(107.5-34) / 49 = 1.50$ DH-7 Jar 6 LI = $(104.6-33) / 56 = 1.28$ DH-8 Jar 4 LI = $(106.5-35) / 49 = 1.46$ DH-8 Jar 9 LI = $(100.2-32) / 47 = 1.45$ DH-9 Jar 2 LI = $(122.9-34) / 50 = 1.78$ DH-9 Jar 6 LI = $(108.0-34) / 47 = 1.57$ DH-10 Jar 3 LI = $(121.7-36) / 54 = 1.59$ DH-10 Jar 5 LI = $(107.6-32) / 43 = 1.76$

Average = 1.54 Standard Deviation = 0.17

SUBJECT Tolchester Channel S-Turn Subsurface InvestigationCOMPUTATIONS Plastic Index, Liquid Index, Activity Index SHEET 4 OF 4 SHEETSCOMPUTED BY JM7AO CHECKED BY _____ DATE 12/29/99Activity Index (AI)

DH-1 Jar 1 AI = $58/24 = 2.42$

DH-1 Jar 4 AI = $45/29 = 1.55$

DH-2 Jar 1 AI = $55/29 = 1.90$

DH-2 Jar 5 AI = $48/29 = 1.66$

DH-3 Jar 6 AI = $45/37 = 1.22$

DH-3 Jar 10 AI = $54/38 = 1.42$

DH-4 Jar 2 AI = $58/32 = 1.81$

DH-4 Jar 9 AI = $45/27 = 1.67$

DH-5 Jar 3 AI = $52/30 = 1.73$

DH-5 Jar 8 AI = $55/30 = 1.83$

DH-6 Jar 3 AI = $45/35 = 1.29$

DH-6 Jar 11 AI = $68/38 = 1.92$

DH-7 Jar 3 AI = $49/32 = 1.53$

DH-7 Jar 6 AI = $56/38 = 1.60$

DH-8 Jar 4 AI = $49/30 = 1.29$

DH-8 Jar 9 AI = $47/34 = 1.38$

DH-9 Jar 2 AI = $50/40 = 1.25$

DH-9 Jar 6 AI = $47/36 = 1.31$

DH-10 Jar 3 AI = $54/31 = 1.74$

DH-10 Jar 5 AI = $43/36 = 1.19$

Average = 1.59 Standard Deviation = 0.31

APPENDIX E
FIELD BORING LOGS

DRILLING LOG		DIVISION North Atlantic Division	INSTALLATION Baltimore District	SHEET 1 OF 1 SHEETS																																									
1. PROJECT <i>Tolchester Channel Realignment</i>			10. SIZE AND TYPE OF BIT <i>1 1/2" ID BY 2" LONG Split Spoon</i>																																										
2. LOCATION (Coordinates or Station) <i>Kent County, Maryland</i>			11. DATUM FOR ELEVATION SHOWN (TBM or MLLW) <i>- 32.3 MLLW</i>																																										
3. DRILLING AGENCY <i>Baltimore District</i>			12. MANUFACTURER'S DESIGNATION OF DRILL <i>Acker AD II</i>																																										
4. HOLE NO. (As shown on drawing title and file number) <i>DH-1</i>			13. TOTAL NO. OF OVER- BURDEN SAMPLES TAKEN <i>7</i>	DISTURBED <i>7</i>	UNDISTURBED <i>0</i>																																								
5. NAME OF DRILLER <i>Dan Bowden</i>			14. TOTAL NUMBER CORE BOXES <i>0</i>																																										
6. DIRECTION OF HOLE <input checked="" type="checkbox"/> VERTICAL <input type="checkbox"/> INCLINED _____ DEG. FROM VERT.			15. ELEVATION GROUND WATER <i>N/A</i>																																										
7. THICKNESS OF OVERTBURDEN <i>14.0</i>			16. DATE HOLE <i>Sep 28, 1999</i>	STARTED <i>Sep 28, 1999</i>	COMPLETED <i>Sep 28, 1999</i>																																								
8. DEPTH DRILLED INTO ROCK <i>0.0</i>			17. ELEVATION TOP OF HOLE <i>- 32.3 MLLW</i>																																										
9. TOTAL DEPTH OF HOLE <i>14.0</i>			18. TOTAL CORE RECOVERY FOR BORING <i>92%</i>																																										
		19. SIGNATURE OF INSPECTOR <i>Michael Saint-Clair</i>																																											
ELEVATION a - MLLW DEPTH b c	LEGEND d	CLASSIFICATION OF MATERIALS (Description)	% CORE RECOV- ERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, motor load, depth of overburden, etc., if significant)																																								
-32 -33 -34 -35 -36 -37 -38 -39 -40 -41 -42 -43 -44 -45 -46		Water 32.3 Channel floor 32.3' below MLLW datum Black & Olive Gray, silty clay, very soft to soft.	45% 100% 95% 100% 100% 100% 100% 80H - 46.3' MLLW	S-1 S-2 S-3 S-4 S-5 S-6 S-7	<p>Drilling operations were accomplished using a truck mounted Acker AD II riggeed aboard a barge.</p> <p><u>Drilling Method</u> The boring was carried with 4" ID steel casing and un-supported in cuttings in increments of 2.0 feet following SPT method guidelines. Some samples were obtained by lowering rods and spoon supported by wireline cable to appropriate depth.</p> <p><u>Sampling Data</u> <table border="1"> <thead> <tr> <th>Sample</th> <th>Depth</th> <th>B.C.</th> <th>PEN</th> <th>Rec.</th> </tr> </thead> <tbody> <tr> <td>S-1</td> <td>32.3 - 34.3</td> <td>WR</td> <td>0.0</td> <td>0.9</td> </tr> <tr> <td>S-2</td> <td>34.3 - 36.3</td> <td>WR</td> <td>0.0</td> <td>2.0</td> </tr> <tr> <td>S-3</td> <td>36.3 - 38.3</td> <td>WR</td> <td>0.0</td> <td>1.9</td> </tr> <tr> <td>S-4</td> <td>38.3 - 40.3</td> <td>WR</td> <td>0.0</td> <td>2.0</td> </tr> <tr> <td>S-5</td> <td>40.3 - 42.3</td> <td>WR</td> <td>0.0</td> <td>2.0</td> </tr> <tr> <td>S-6</td> <td>42.3 - 44.3</td> <td>WR</td> <td>0.0</td> <td>2.0</td> </tr> <tr> <td>S-7</td> <td>44.3 - 46.3</td> <td>WR</td> <td>0.0</td> <td>2.0</td> </tr> </tbody> </table> Time (Start): 1510 Bounding: 33.0' Tide (+/-): - 0.7' <i>32.3</i> </p> <p>Drill Hole Coordinates E: 1518699.05 N: 556673.83</p> <p>PRELIMINARY INSPECTOR'S LOG CLASSIFICATION NOT FINAL</p>	Sample	Depth	B.C.	PEN	Rec.	S-1	32.3 - 34.3	WR	0.0	0.9	S-2	34.3 - 36.3	WR	0.0	2.0	S-3	36.3 - 38.3	WR	0.0	1.9	S-4	38.3 - 40.3	WR	0.0	2.0	S-5	40.3 - 42.3	WR	0.0	2.0	S-6	42.3 - 44.3	WR	0.0	2.0	S-7	44.3 - 46.3	WR	0.0	2.0
Sample	Depth	B.C.	PEN	Rec.																																									
S-1	32.3 - 34.3	WR	0.0	0.9																																									
S-2	34.3 - 36.3	WR	0.0	2.0																																									
S-3	36.3 - 38.3	WR	0.0	1.9																																									
S-4	38.3 - 40.3	WR	0.0	2.0																																									
S-5	40.3 - 42.3	WR	0.0	2.0																																									
S-6	42.3 - 44.3	WR	0.0	2.0																																									
S-7	44.3 - 46.3	WR	0.0	2.0																																									

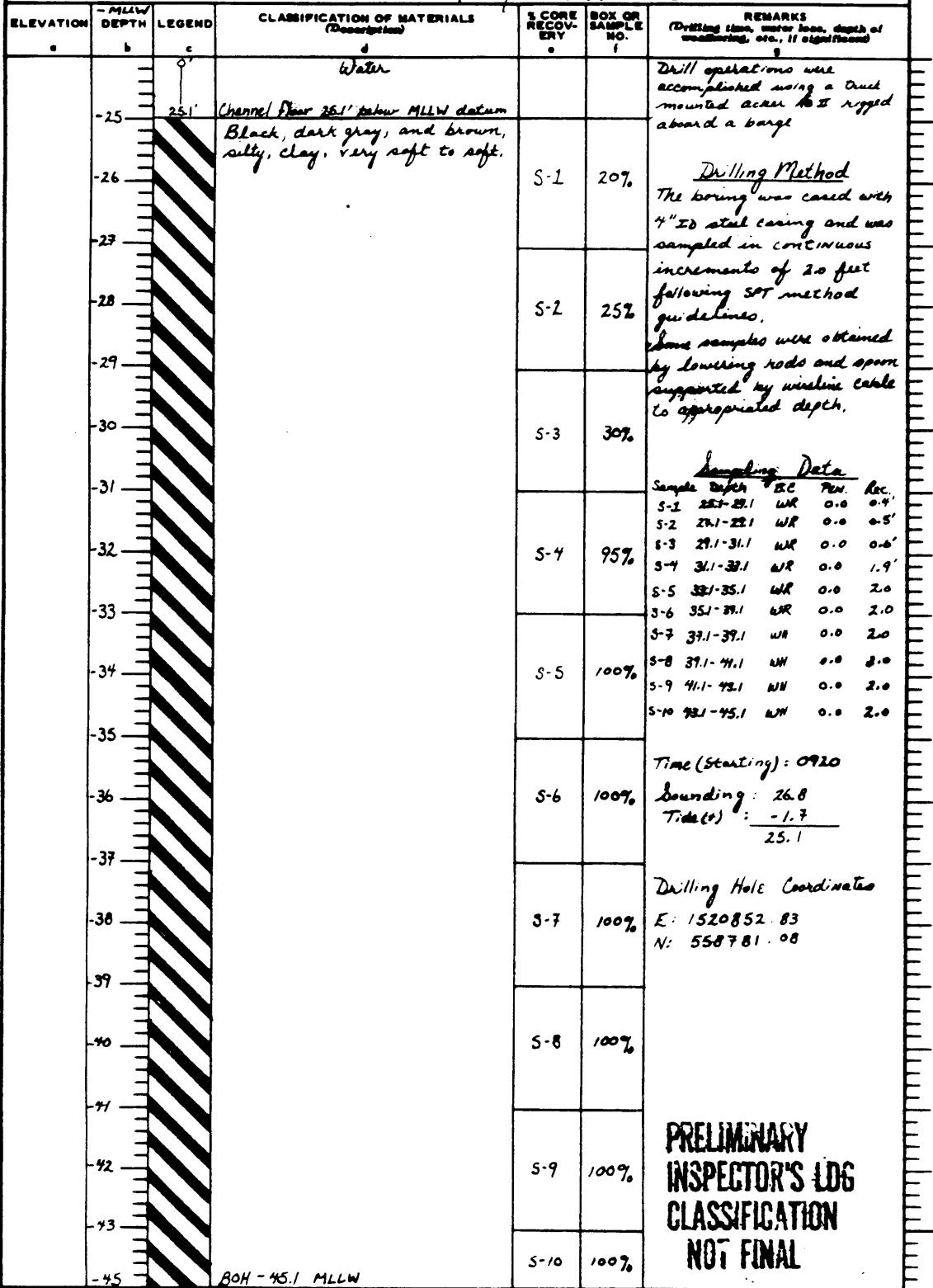
DRILLING LOG		DIVISION North Atlantic Division	INSTALLATION Baltimore District	SHEET 1 OF 1 SHEETS		
1. PROJECT <i>Tolchester Channel Realignment</i>		10. SIZE AND TYPE OF BIT $1\frac{3}{8}$ " ID By 2' Long Spud: Spoon				
2. LOCATION (Coordinates or Station)		11. DATUM FOR ELEVATION SHOWN (TBM = MLLW) -29.6 MLLW				
Kent County, Maryland		12. MANUFACTURER'S DESIGNATION OF DRILL <i>Acker AD II</i>				
3. DRILLING AGENCY <i>Baltimore District</i>		13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN DISTURBED UNDISTURBED <i>8</i>				
4. HOLE NO. (As shown on drawing title and file number) <i>DH-2</i>		14. TOTAL NUMBER CORE BOXES 0				
5. NAME OF DRILLER <i>Dan Bowden</i>		15. ELEVATION GROUND WATER N/A				
6. DIRECTION OF HOLE <input checked="" type="checkbox"/> VERTICAL <input type="checkbox"/> INCLINED DEG. FROM VERT.		16. DATE HOLE STARTED COMPLETED <i>Sep 28, 1999</i> <i>Sep 28, 1999</i>				
7. THICKNESS OF OVERTBURDEN 16.0'		17. ELEVATION TOP OF HOLE -29.6' MLLW				
8. DEPTH DRILLED INTO ROCK 0.0'		18. TOTAL CORE RECOVERY FOR BORING 99%				
9. TOTAL DEPTH OF HOLE 16.0'		19. SIGNATURE OF INSPECTOR <i>Michael Sant-Clark</i>				
ELEVATION	MLLW DEPTH	LEGEND	CLASSIFICATION OF MATERIALS (Description)	% CORE RECOV- ERY	BOX OR SAMPLE NO.	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant)
0'			Water			<i>Drilling Operations were accomplished using a crane mounted Acker AD II rigged aboard a barge</i>
-29						<i>Drilling Method</i>
-29.6'			Channel floor 29.6' below MLLW datum			The boring rod was cased with a 4" I.D. steel casing and was sampled in 2.5' increments using SPT record for selection.
-30			Black and Olive, silty, sandy, Clay, very soft to soft, shells between -33.6 to 35.6 MLLW.	S-1	95%	<i>Some samples were obtained by lowering rods and spud supported by wireline cable to appropriate depth.</i>
-31				S-2	100%	
-32				S-3	100%	<i>Sampling Data</i>
-33				S-4	100%	Sample Depth B.C. Pen. No. S-1 29.6-31.6 WR 0.0 1.9 S-2 31.6-33.6 WR 0.0 2.0 S-3 33.6-35.6 WR 0.0 2.0 S-4 35.6-37.6 WR 0.0 2.0 S-5 37.6-39.6 WR 0.0 2.0 S-6 39.6-41.6 WR 0.0 2.0 S-7 41.6-43.6 WR 0.0 2.0 S-8 43.6-45.6 WR 0.0 2.0
-34				S-5	100%	
-35				S-6	100%	Time (start): 1620
-36				S-7	100%	Bounding: 30.4' T. depth: 0.8' 29.6'
-37				S-8	100%	Dr. 4 hole location: E: 1519552.60 N: 557238.11
-38						
-39						
-40						
-41						
-42						
-43						
-44						
-45						
			BOH - 45.6' MLLW			

DRILLING LOG		DIVISION North Atlantic Division	INSTALLATION Baltimore District	SHEET 2 OF 1 SHEETS
1. PROJECT <i>Tolchester Channel Realignment</i>		10. SIZE AND TYPE OF BIT 1 1/8" ID by 2' LONG Split Spoon		
2. LOCATION (Coordinates or Name) <i>Kent Country, Maryland</i>		11. DAY/TIME FOR ELEVATION BORROW (TIDE = MSLW) <i>-26.5' MLLW</i>		
3. DRILLING AGENCY <i>Baltimore District</i>		12. MANUFACTURER'S DENOMINATION OF DRILL <i>Ocker AD II</i>		
4. HOLE NO. (As shown on drawing sheet and site number) <i>DH-3</i>		13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN <i>10</i> DISTURBED UNDISTURBED		
5. NAME OF DRILLER <i>DAN BOWDEN</i>		14. TOTAL NUMBER CORE BOXES 0		
6. DIRECTION OF HOLE <input checked="" type="checkbox"/> VERTICAL <input type="checkbox"/> INCLINED DEG. FROM VERT.		15. ELEVATION GROUND WATER N/A		
7. THICKNESS OF OVERBURDEN 20.0		16. DATE HOLE STARTED COMPLETED <i>Sep. 29, 1999 Sep. 29, 1999</i>		
8. DEPTH DRILLED INTO ROCK 0.0		17. ELEVATION TOP OF HOLE - 26.5 MLLW		
9. TOTAL DEPTH OF HOLE 20.0		18. TOTAL CORE RECOVERY FOR BORING 84%		
		19. SIGNATURE OF INSPECTOR <i>Michael Saint-Clair</i>		
ELEVATION	- MLLW DEPTH	LEGEND	CLASSIFICATION OF MATERIALS (Description)	
			% CORE RECOVERY	BOX OR SAMPLE NO.
0	0'	Water		
-26	26.5'	channel floor 26.5' below MLLW datum		
-27		Black, dark gray, and olive silty clay, very soft to soft.	S-1	45% Drilling operations were accomplished using a truck mounted Ocker AD II riggeed aboard a barge
-28			S-2	15% Drilling Method The boring was cased with 4" x 20 steel casing and was sampled in continuous increments of 2.0 feet. Following SPT method guidelines, some samples were obtained by lowering rods and spoon supported by wireline cable to appropriate depth.
-29			S-3	80% Sampling Data Sample Depth B.C. Pen. Rec. S-2 26.5-28.5 WR 0.0 0.9 S-2 28.5-30.5 WR 0.0 0.3 S-3 30.5-32.5 WR 0.0 1.6 S-4 32.5-34.5 WR 0.0 2.0 S-5 34.5-36.5 WR 0.0 2.0 S-6 36.5-38.5 WR 0.0 2.0 S-7 38.5-40.5 WR 0.0 2.0 S-8 40.5-42.5 WR 0.0 2.0 S-9 42.5-44.5 WR 0.0 2.0 S-10 44.5-46.5 WH 0.0 2.0
-30			S-4	100% Time (start): 0740 bounced: 27.8' Tide(s): - 1.3' 26.5'
-31			S-5	100% Drill Hole Coordinates E: 1519961.08 N: 550107.18
-32			S-6	100%
-33			S-7	100%
-34			S-8	100%
-35			S-9	100%
-36			S-10	100%
-37				
-38				
-39				
-40				
-41				
-42				
-43				
-44				
-45				
BOH - 46.5' MLLW				

**PRELIMINARY
INSPECTOR'S LOG
CLASSIFICATION
NOT FINAL**

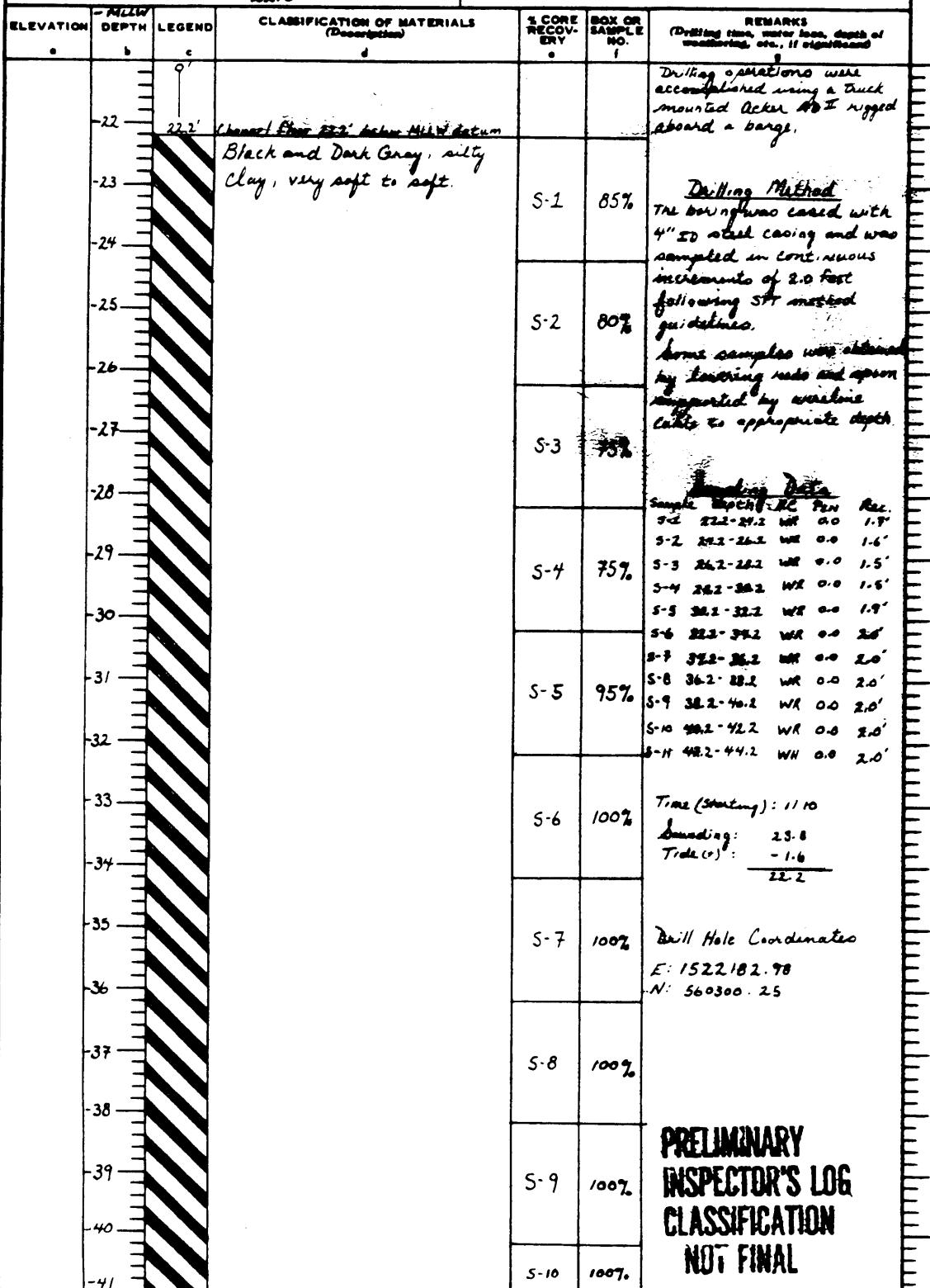
Hole No. DH-4

DRILLING LOG		DIVISION North Atlantic Division	INSTALLATION Baltimore District	Sheet 1 of 2 Sheets
1. PROJECT <i>Tolchester Channel Realignment</i>		10. SIZE AND TYPE OF BIT 1 1/8" ID By 2' Long Split Spoon		
2. LOCATION (Coordinates or Section) <i>KENT Country, Maryland</i>		11. DATUM FOR ELEVATION SHOWN (TIDE or MSL)		
3. DRILLING AGENCY <i>Baltimore District</i>		-25.1 MLLW		
4. HOLE NO. (As shown on drawing title and file numbers) <i>DH-4</i>		12. MANUFACTURER'S DESIGNATION OF DRILL <i>Ocker AD II</i>		
5. NAME OF DRILLER <i>Dan Bowden</i>		13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN <i>10</i> DISTURBED UNDISTURBED		
6. DIRECTION OF HOLE <input checked="" type="checkbox"/> VERTICAL <input type="checkbox"/> INCLINED DEG. FROM VERT.		14. TOTAL NUMBER CORE BOXES <i>0</i>		
7. THICKNESS OF OVERTBURDEN 20.0		15. ELEVATION GROUND WATER <i>N/A</i>		
8. DEPTH DRILLED INTO ROCK 0.0		16. DATE HOLE STARTED <i>Sep. 29, 1999</i> COMPLETED <i>Sep. 29, 1999</i>		
9. TOTAL DEPTH OF HOLE 20.0		17. ELEVATION TOP OF HOLE -25.1 MLLW		
		18. TOTAL CORE RECOVERY FOR BORING 77%		
		19. SIGNATURE OF INSPECTOR <i>Michael Saint-Clark</i>		



DRILLING LOG		DIVISION North Atlantic Division	INSTALLATION Baltimore District	Sheet 1 of 1 Sheets		
1. PROJECT <i>Tolchester Channel Realignment</i>		10. SIZE AND TYPE OF BIT 1 1/2" ID BY 2" LONG SPLIT SPON				
2. LOCATION <i>Kent County, Maryland</i>		11. DATUM FOR ELEVATION MEASURED (TIDE OR MSL)		<i>-25.3 MLLW</i>		
3. DRILLING AGENT <i>Baltimore District</i>		12. MANUFACTURER'S DESIGNATION OF DRILL		<i>Acker AD II</i>		
4. HOLE NO. (As shown on drawing sheet and site number) <i>DH-5</i>		13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN		DISTURBED <i>10</i>	UNDISTURBED —	
5. NAME OF DRILLER <i>Dan Bowden</i>		14. TOTAL NUMBER CORE BOXES		0		
6. DIRECTION OF HOLE <input checked="" type="checkbox"/> VERTICAL <input type="checkbox"/> INCLINED DEG. FROM VERT.		15. ELEVATION GROUND WATER		N/A		
7. THICKNESS OF OVERTBURDEN 20.0		16. DATE HOLE		STARTED <i>Sep 29, 1999</i>	COMPLETED <i>Sep 29, 1999</i>	
8. DEPTH DRILLED INTO ROCK 0.0		17. ELEVATION TOP OF HOLE -25.3 MLLW				
9. TOTAL DEPTH OF HOLE 20.0		18. TOTAL CORE RECOVERY FOR BORING 75%				
		19. SIGNATURE OF INSPECTOR <i>Michael Saint-Clair</i>				
ELEVATION - MLLW	DEPTH ft	LEGEND	CLASSIFICATION OF MATERIALS (Description)	CORE RECOV. ERY %	BOX OR SAMPLE NO. #	REMARKS (Drilling time, water level, depth of weathering, etc., if significant)
0'			Water	0		
-25	25.3'		Channel Floor 25.3' below MLLW datum Black and Brown, silty, sandy, Clay, very soft to soft, shells.			<i>Drilling operations were accomplished using a truck mounted Acker AD II rigged aboard a barge.</i>
-26				S-1	60%	<i>Drilling Method The boring was cased with 4" ID steel casing and was sampled in continuous increments of 2.0 feet following soil method guidelines.</i>
-27				S-2	35%	<i>Some samples were obtained by lowering rods and open capped by wireline tubing to appropriate depth.</i>
-28				S-3	25%	
-29				S-4	50%	
-30				S-5	80%	<i>Sampling Data Sample Depth GL Pen Rec. S-1 26.3-27.3 WR 0.0 1.2' S-2 27.3-28.3 WR 0.0 0.7' S-3 28.3-31.3 WR 0.0 0.5' S-4 31.3-32.3 WR 0.0 1.0' S-5 32.3-35.3 WR 0.0 1.6' S-6 35.3-37.3 WR 0.0 2.0' S-7 37.3-39.3 WR 0.0 2.0' S-8 39.3-41.3 WR 0.0 2.0' S-9 41.3-42.3 WR 0.0 2.0' S-10 42.3-45.3 WR 0.0 2.0</i>
-31				S-6	100%	<i>Time (Start): 1030 Duration: 26.9' Tide(s): -1.6' 25.3'</i>
-32				S-7	100%	<i>Drill Hole Coordinates E: 1521307.02 N: 559725.74</i>
-33				S-8	100%	
-34				S-9	100%	
-35				S-10	100%	
-36						
-37						
-38						
-39						
-40						
-41						
-42						
-43						
-44						
-45						
AOH - 45.3' MLLW						PRELIMINARY INSPECTOR'S LOG CLASSIFICATION NOT FINAL

DRILLING LOG		DIVISION North Atlantic Division	INSTALLATION Baltimore District	SHEET 1 OF 2 SHEETS	
1. PROJECT <i>Talchester Channel Realignment</i>		10. SIZE AND TYPE OF BIT 1 1/2" ID BY 2' LONG SPL. C SPOON - 22.2 MLLW			
2. LOCATION (Coordinates or Station) <i>Kent County, Maryland</i>		11. DATE FOR ELEVATION SHOWN (Year - Month - Day)			
3. DRILLING AGENCY <i>Baltimore District</i>		12. MANUFACTURER'S DESIGNATION OF DRILL <i>Ocker AD II</i>			
4. HOLE NO. (As shown on drawing title and site record) <i>DH-6</i>		13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN		DISTURBED <i>11</i>	UNDISTURBED <i>-</i>
5. NAME OF DRILLER <i>Don Borden</i>		14. TOTAL NUMBER CORE BOXES 0			
6. DIRECTION OF HOLE <input checked="" type="checkbox"/> VERTICAL <input type="checkbox"/> INCLINED DEG. FROM VERT.		15. DATE HOLE STARTED Sep. 29, 1999 COMPLETED Sep. 29, 1999			
7. THICKNESS OF OVERTBURDEN 22.0		17. ELEVATION TOP OF HOLE - 22.2 MLLW			
8. DEPTH DRILLED INTO ROCK 0.0		18. TOTAL CORE RECOVERY FOR BORING 92%			
9. TOTAL DEPTH OF HOLE 22.0		19. SIGNATURE OF INSPECTOR			



DRILLING LOG (Cont Sheet)			ELEVATION TOP OF HOLE - 22.2 MLLW	Hole No. DH-6		
PROJECT Tolchester Channel Realignment			INSTALLATION Baltimore District	SHEET 2 OF 2 SHEETS		
ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOV. e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	-42			S-10	100%	
	-43			S-11	100%	
	-44		BOH - 44.2' MLLW			
	-45					

PRELIMINARY
INSPECTOR'S LOG
CLASSIFICATION
NOT FINAL

DRILLING LOG		DIVISION North Atlantic Division	INSTALLATION Baltimore District	Hole No. DH-7		
1. PROJECT <i>Tolchester Channel Realignment</i>		SHEET 1 OF 2 SHEETS				
2. LOCATION (Coordinates or Section) <i>Kent County, Maryland</i>		10. SIZE AND TYPE OF BIT $1\frac{5}{8}$ " ID. BY 2' Long Splice Spoon				
		11. DATUM FOR ELEVATION SHOWN (TIDE OR MSL)				
		- 21.1 MLLW				
3. DRILLING AGENCY <i>Baltimore District</i>		12. MANUFACTURER'S DENOMINATION OF DRILL <i>Acker AD II</i>				
4. HOLE NO. (As shown on drawing title and site number) <i>DH-7</i>		13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN 12 DISTURBED - UNDISTURBED				
5. NAME OF DRILLER <i>Dan Bowden</i>		14. TOTAL NUMBER CORE BOXES 0				
6. DIRECTION OF HOLE <input checked="" type="checkbox"/> VERTICAL <input type="checkbox"/> INCLINED DEG. FROM VERT.		15. ELEVATION GROUND WATER N/A				
7. THICKNESS OF OVERBURDEN 24.0'		16. DATE HOLE STARTED COMPLETED Sep. 29, 1999 Sep. 29, 1999				
8. DEPTH DRILLED INTO ROCK 0.0		17. ELEVATION TOP OF HOLE - 21.1 MLLW				
9. TOTAL DEPTH OF HOLE 24.0'		18. TOTAL CORE RECOVERY FOR BORING 87%				
		19. SIGNATURE OF INSPECTOR <i>Michael Raant-Clair</i>				
ELEVATION - MLLW	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant)
-0'			Water			
-21	21.1'		Channel Floor - 21.1' below MLLW datum			Drilling operations were accomplished using a truck mounted Acker AD II riggeed aboard a barge
-22			Black and Brown, silty, sandy, clay, very soft to soft, shell fragments - 40.2 m - 41.1 MLLW	S-1	65%	<u>Drilling Method</u> The boring was cased with 4" ID. casing and was sampled in continuous increments of 2.0 feet following SPT method guidelines.
-23				S-2	60%	
-24				S-3	75%	Some samples were obtained by lowering rods and spoon supported by wireline cable to appropriate depth.
-25				S-4	80%	
-26				S-5	65%	
-27				S-6	100%	<u>Sample Data</u> Sample Depth B.C. Pen. Rec. S-1 21.1-23.1 WR 0.0 1.3' S-2 23.1-25.1 WR 0.0 1.2' S-3 25.1-27.1 WR 0.0 1.5' S-4 27.1-29.1 WR 0.0 1.6' S-5 29.1-31.1 WR 0.0 1.3' S-6 31.1-33.1 WR 0.0 2.0 S-7 33.1-35.1 WR 0.0 2.0 S-8 35.1-37.1 WR 0.0 2.0 S-9 37.1-39.1 WR 0.0 2.0 S-10 39.1-41.1 WH 0.0 2.0 S-11 41.1-43.1 WH 0.0 2.0 S-12 43.1-45.1 WR 0.0 2.0
-28				S-7	100%	
-29				S-8	100%	
-30				S-9	100%	
-31				S-10	100%	
-32						Time (Starting): 1220
-33						Duration: 22.2'
-34						Tide (ft): - 1.1'
-35						21.1'
-36						
-37						Drill Hole Coordinates
-38						E: 1522649.14
-39						N: 561219.73
-40						

**PRELIMINARY
INSPECTOR'S LOG
CLASSIFICATION
NOT FINAL**

DRILLING LOG (Cont Sheet)			EL ELEVATION TOP OF HOLE -21.1' MLLW	Hole No. DH-7				
PROJECT	Tolchester Channel Realignment		INSTALLATION	Baltimore District				
ELEVATION	-MLLW	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS (Description)	% CORE RECOV. EERY	BOX OR SAMPLE NO.	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant)	SHEET OR SHEETS
	b	c		d	e	f		
-41					S-10	100%		
-42					S-11	100%		
-43								
-44					S-12	100%		
-45								
-46								
				BOH -45.1' MLLW				

PRELIMINARY
INSPECTOR'S LOG
CLASSIFICATION,
NOT FINAL

DRILLING LOG		DIVISION North Atlantic Division		INSTALLATION Baltimore District		Hole No. DH-0	
1. PROJECT <i>Talbot Channel Realignment</i>				10. SIZE AND TYPE OF BIT <i>1 1/2" SB by 2' Long Split Spoon</i>		SHEET 2 OF 1 SHEETS	
2. LOCATION (Coordinates or Station) <i>Anne Arundel County, Maryland</i>				11. DATUM FOR ELEVATION SHOWN <i>Mean Sea Level</i>		<i>-25.8 MLLW</i>	
3. DRILLING AGENCY <i>Baltimore District</i>				12. MANUFACTURER'S DESIGNATION OF DRILL <i>Ocker AD</i>			
4. DRILL NO. (As shown on drawing sheet) <i>DH-8</i>				13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN <i>10</i>		DISTURBED <i>10</i>	UNDISTURBED <i>-</i>
5. NAME OF DRILLER <i>John Bowden</i>				14. TOTAL NUMBER CORE BOXES <i>0</i>			
6. DIRECTION OF HOLE <input checked="" type="checkbox"/> VERTICAL <input type="checkbox"/> INCLINED _____ DEG. FROM VERT.				15. ELEVATION GROUND WATER <i>N/A</i>			
7. THICKNESS OF OVERBURDEN <i>20.0</i>				16. DATE HOLE STARTED <i>Sep 29, 1999</i>		COMPLETED <i>Sep. 29, 1999</i>	
8. DEPTH DRILLED INTO ROCK <i>0.0</i>				17. ELEVATION TOP OF HOLE - <i>25.8 MLLW</i>			
9. TOTAL DEPTH OF HOLE <i>20.0</i>				18. TOTAL CORE RECOVERY FOR BORING <i>74%</i>			
				19. SIGNATURE OF INSPECTOR <i>Michael Bent-Clair</i>			
ELEVATION - MLLW	DEPTH a	LEGEND b	CLASSIFICATION OF MATERIALS (Description) c	% CORE RECOVERY d	BOX OR SAMPLE NO. e	REMARKS (Drilling time, motor hrs., depth of sounding, etc., if significant)	
0			<i>wash</i>			<i>Drilling operations were accomplished using a deck mounted Ocker 18 II riggded aboard a barge</i>	
-25.8			<i>Clayey sand, some shell fragments, olive and black, with clay, shell fragments, very soft to soft.</i>			<i>Drilling Method</i> The boring was cored with 4" ID steel casing and was sampled in continuous increments of 20 feet following NTR method guidelines. Some samples were obtained by lowering rods and again supported by wireline cable to appropriate depth	
-26				S-1	45%		
-27				S-2	30%		
-28				S-3	30%		
-29				S-4	50%	<i>Drilling Data</i> Sample No. El. Pov. Rec. S-1 28.0-28.8 WR 0.0 0.9' S-2 28.8-29.6 WR 0.0 0.6' S-3 29.6-30.4 WR 0.0 0.6' S-4 30.4-31.2 WR 0.0 1.0' S-5 31.2-32.0 WR 0.0 1.7' S-6 32.0-32.8 WR 0.0 2.0' S-7 32.8-33.6 WR 0.0 2.0' S-8 33.6-34.4 WR 0.0 2.0' S-9 34.4-35.2 WR 0.0 2.0' S-10 35.2-45.0 WR 0.0 2.0'	
-30				S-6	100%	<i>Time (Drilling) : 1625</i> <i>Sounding: 26.6'</i> <i>Tide(0) - 0.0'</i> <i>25.8'</i>	
-31				S-7	100%	<i>Drill Hole Coordinates</i> E: 1523464.22 N: 561767.26	
-32				S-8	100%		
-33				S-9	100%		
-34				S-10	100%	<i>PRELIMINARY INSPECTOR'S LOG CLASSIFICATION NOT FINAL</i>	
-35							
-36							
-37							
-38							
-39							
-40							
-41							
-42							
-43							
-44							
-45			<i>BOR - 45.0' MLLW</i>				

DRILLING LOG		DIVISION North Atlantic Division	INSTALLATION Baltimore District	SHEET 1 OF SHEETS		
1. PROJECT Tolchester Channel Realignment		10. SIZE AND TYPE OF BIT 1 1/2" I.D. BY 2" Long Split Spoon				
2. LOCATION (Coordinates or Station) Kent County, Maryland		11. DATUM FOR ELEVATION SHOWN (TBM or MLLW) - 33 3' MLLW				
3. DRILLING AGENCY Baltimore District		12. MANUFACTURER'S DESIGNATION OF DRILL Acker AD II				
4. HOLE NO. (As shown on drawing sheet and file number) DH-9		13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN 6 DISTURBED UNDISTURBED				
5. NAME OF DRILLER Dan Bonner		14. TOTAL NUMBER CORE BOXES 0				
6. DIRECTION OF HOLE <input checked="" type="checkbox"/> VERTICAL <input type="checkbox"/> INCLINED DEG. FROM VERT.		15. ELEVATION GROUND WATER N/A				
7. THICKNESS OF OVERTBURDEN 12.0		16. DATE HOLE STARTED COMPLETED Oct 1, 1999 Oct 1, 1999				
8. DEPTH DRILLED INTO ROCK -		17. ELEVATION TOP OF HOLE - 33.3' MLLW				
9. TOTAL DEPTH OF HOLE 12.0		18. TOTAL CORE RECOVERY FOR BORING 84%				
		19. SIGNATURE OF INSPECTOR Michael Scott-Cleir				
ELEVATION a	- MLLW DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d		REMARKS (Drilling time, water loss, depth of overburden, etc., if significant)	
			% CORE RECOVERY e	BOX OR SAMPLE NO. f		
	0		Water			
-32					Drilling operations were accomplished using a truck mounted Acker AD II rigged aboard a barge	
-33	33.3'		Channel Floor - 33.3' below MLLW datum Black and Olive, silty, sandy Clay, very soft to soft.	40%	S-1	Drilling Method The boring was cased with 4" I.D. steel casing and was sampled in continuous increments of 20 feet following SPT method guidelines. Some samples were obtained by lowering rods and spuds supported by wireline cable to appropriate depth.
-34				70%	S-2	
-35						
-36				100%	S-3	
-37						
-38				95%	S-4	
-39						
-40				100%	S-5	
-41						
-42						
-43						
-44						
-45			BOH - 45.3' MLLW			
-46						
						Sampling Data Sample Depth B.C. Per Rec. S-1 33.3-35.3 WR 0.0 0.8 S-2 35.3-37.3 WR 0.0 1.4 S-3 37.3-39.3 WR 0.0 2.0 S-4 39.3-41.3 WR 0.0 1.9 S-5 41.3-43.3 WR 0.0 2.0 S-6 43.3-45.3 WR 0.0 2.0
						Time (Starting): 0830 Sounding: 34.0 Tide(s): -0.7 33.3
						Drill Hole Coordinates E: 1524118.69 N: 563387.39
						PRELIMINARY INSPECTOR'S LOG CLASSIFICATION NOT FINAL

DRILLING LOG		DIVISION North Atlantic Division	INSTALLATION Baltimore District	SHEET 1 OF SHEETS		
1. PROJECT <i>Tolchester Channel Realignment</i>	10. SIZE AND TYPE OF BIT 3 1/2" ID. 6 1/2" Long Split Spud					
2. LOCATION (Coordinates or Station) <i>Kent County, Maryland</i>	11. DATUM FOR ELEVATION SHOWN (TIDE OR MSL)					
3. DRILLING AGENCY <i>Baltimore District</i>	12. MANUFACTURER'S IDENTIFICATION OF DRILL <i>Acker AD II</i>					
4. HOLE NO. (As shown on drawing and/or and site number) <i>DA-10</i>	13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN <i>5</i>					
5. NAME OF DRILLER <i>Dan Bowden</i>	14. TOTAL NUMBER CORE BOXES <i>0</i>					
6. DIRECTION OF HOLE <input checked="" type="checkbox"/> VERTICAL <input type="checkbox"/> INCLINED DEG. FROM VERT.	15. ELEVATION GROUND WATER <i>N/A</i>					
7. THICKNESS OF OVERTUREN <i>10.0</i>	16. DATE HOLE STARTED <i>Oct 1, 1999</i>					
8. DEPTH DRILLED INTO ROCK <i>-</i>	17. ELEVATION TOP OF HOLE + 36.1 MLLW					
9. TOTAL DEPTH OF HOLE <i>10.0</i>	18. TOTAL CORE RECOVERY FOR BORING 79%					
19. SIGNATURE OF INSPECTOR <i>Michael Saint-Clair</i>						
ELEVATION - MLLW	DEPTH a	LEGEND b	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOV- ERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of overburden, etc., H alignment)
	0		Water			
-35						<i>Drilling operations were accomplished using a truck mounted Acker AD II rigg'd aboard a barge</i>
-36	36.1		<i>Channel Cut - 36.1' below MLLW datum</i>			<i>Drilling Method</i>
-37			<i>Black and olive, silty, sandy clay, very soft to soft.</i>	45%	S-1	<i>The boring was cased with 4 1/2" steel casing and was sampled in continuous increments of 2.0 feet following SPT method guidelines.</i>
-38						<i>Some samples were obtained by lowering rods and spoon supported by wireline cable to appropriate depth.</i>
-39				50%	S-2	
-40						<i>Sampling Depth</i>
-41						<i>Sample depth 60.0' msl. see S-1 36.1-38.1 WR 0.0 0.9 S-2 38.1-40.1 WR 0.0 1.0 S-3 40.1-42.1 WR 0.0 2.0 S-4 42.1-44.1 WR 0.0 2.0 S-5 44.1-46.1 WR 0.0 2.0</i>
-42						
-43						<i>Time (Start) . 0730</i>
-44						<i>Soundings: 36.6</i>
-45						<i>Tide (+) : - 0.5</i>
-46			<i>BOH - 46 1' MLLW</i>	100%	S-4	<i>36.1</i>
-47						
						<i>Drill Hole Coordinates E: 1524032.45 N: 562576.34</i>
PRELIMINARY INSPECTOR'S LOG CLASSIFICATION NOT FINAL						

APPENDIX F

Ft. McHenry Bench Mark Data

PUBLICATION DATE: 03/28/1988

Page 1

MARYLAND 857 4680

U.S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NATIONAL OCEAN SERVICE

TIDAL BENCH MARKS

BALTIMORE (FORT McHENRY), PATAPSCO RIVER

LATITUDE: $39^{\circ} 16.0' N$ LONGITUDE: $76^{\circ} 34.7' W$
 NOAA CHART: 12281 USGS QUAD: BALTIMORE EAST

To reach the tidal bench marks from the north bound Baltimore-Washington Expressway (State Highway 295) take the Water View exit east to State Highway 2 (Hanover Street), proceed north on Hanover Street for 1.5 miles (2.4 km) to Fort Avenue, turn right and travel east on Fort Avenue for 1.8 miles (2.9 km) to the entrance of Fort McHenry, turn left onto Wallace Avenue, then right again onto Nimitz Drive and then left onto Halsey Road to its end, turn right and continue past a gate to the U.S. Corps of Engineers (COE) compound. The bench marks are located in the U.S. Naval Reserve compound, the COE compound, and on the Fort McHenry grounds. The tide gage and staff are located on the COE pier.

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BENCH MARK STAMPING: 25 1919

MONUMENTATION: Survey Disk

VM#: 427
PID#: JV0583

AGENCY:

SETTING CLASSIFICATION: Concrete Monument

The bench mark is set in the top of a concrete monument in the COE compound, 46.3 feet (14.1 m) east of the NE corner of the COE soil laboratory (a single story structure with yellow siding), 38 feet (12 m) south of the edge of the sea wall, and 0.5 foot (0.2 m) above the ground.

BENCH MARK STAMPING: 27 1922

MONUMENTATION: Survey Disk

VM#: 429
PID#: JV0579

AGENCY:

SETTING CLASSIFICATION: Granite Foundation

The bench mark is set in the center of an octagon shaped granite cannon base at the easternmost point of the star shaped fort at Fort McHenry grounds, 150 feet (46 m) ESE of the fort flagpole, 5.5 feet (1.7 m) ESE of a pile of cannon balls, and 0.4 foot (0.1 m) east of the west edge of the base.

BENCH MARK STAMPING: 28 1922

MONUMENTATION: Survey Disk

VM#: 430
PID#: JV0580

AGENCY:

SETTING CLASSIFICATION: Concrete Foundation

The bench mark is set in the east corner of the 3-foot (1 m) square concrete sub-base on the east leg of a range beacon near the east end of the Fort McHenry grounds, 53.7 feet (16.4 m) south of the SW leg of an electric meter box, 41.8 feet (12.7 m) WNW of the offshore edge of the sea wall, 1.1 feet (0.3

m) east of the east leg of the beacon, and 0.4 foot (0.1 m) below the ground.

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BALTIMORE (FORT MCHENRY), PATAPSCO RIVER

BENCH MARK STAMPING: 29 1922

MONUMENTATION: Survey Disk

VM#: 431

AGENCY:

PID#: JV0582

SETTING CLASSIFICATION: Granite Sea Wall

The bench mark is set in the sea wall cap in the COE compound, 61.3 feet (18.7 m) NE of the doorway of Building 2609, 26.6 feet (8.1 m) SE of the centerline of the fire boat pier, and 1 foot (0.3 m) south of the north edge of the sea wall cap.

BENCH MARK STAMPING: 30 1922

MONUMENTATION: Survey Disk

VM#: 432

AGENCY:

PID#: JV0584

SETTING CLASSIFICATION: Granite Sill

The bench mark is set in the top of a granite sill in the COE compound, 20 feet (6 m) west of the centerline of a paved road between the fire department barracks and soil laboratory, 6.7 feet (2.0 m) south of the NE corner of a warehouse, and 3 feet (1 m) above the ground.

BENCH MARK STAMPING: 31 1922

MONUMENTATION: Survey Disk

VM#: 433

AGENCY:

PID#: JV0585

SETTING CLASSIFICATION: Granite Sill

The bench mark is set in the top of a granite door sill of the U.S. Naval Reserve Center boiler room at the north end of Halsey Road, 44.7 feet (13.6 m) north of the NW corner of the main Naval Reserve Center Building, 18.0 feet (5.5 m) NNE of the centerline of the entrance road to the COE compound, 4.6 feet (1.4 m) NW of the edge of the top step, and 3 feet (1 m) above the ground.

BENCH MARK STAMPING: 32 1922

MONUMENTATION: Survey Disk

VM#: 434

AGENCY:

PID#: JV0586

SETTING CLASSIFICATION: Granite Sill

The bench mark is set in the top of a granite door sill on the west side of the U.S. Naval Reserve Center Building, 65.1 feet (19.8 m) NE of the SW corner of the building, 33.0 feet (10.1 m) SE of the centerline of Halsey Road, and 1.4 feet (0.4 m) above the sidewalk.

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BALTIMORE (FORT MCHENRY), PATAPSCO RIVER

BENCH MARK STAMPING: 35 1922

MONUMENTATION: Survey Disk

VM#: 435

AGENCY:

PID#: JV0576

SETTING CLASSIFICATION: Granite Sill

The bench mark is set in the main entrance door sill to the Southern States Coop Mills office building at the intersection of East Fort Avenue and Wallace Street, 127 feet (39 m) SSW of the centerline of Fort Avenue, 37.8 feet (11.5 m) WNW of the brick wall around the Fort McHenry grounds, and 0.5 foot (0.2 m) SE of the west side of the entrance way to the building.

BENCH MARK STAMPING: 4680 A 1980

MONUMENTATION: Survey Disk

VM#: 436

AGENCY:

PID#:

SETTING CLASSIFICATION: Galvanized Steel Rod

The bench mark is located in the COE compound in line with a line of maple trees, 122.9 feet (37.5 m) NNW of a flagpole, 90.6 feet (27.6 m) north of the NW corner of the office building, and 42.1 feet (12.8 m) SW of a power pole at the end of the pier. The bench mark is 0.1 foot (0.03 m) below the ground, crimped to a galvanized steel rod driven 37 feet (11 m) to refusal.

BENCH MARK STAMPING: NO STAMPING 1

MONUMENTATION: Survey Disk

VM#: 437

AGENCY:

PID#: JV0578

SETTING CLASSIFICATION: Concrete Monument

The bench mark is set in the top of a concrete monument in the grassy area between the Francis Scott Key memorial statue and the visitors center on the For McHenry grounds, 292.0 feet (89.0 m) east of the east face of the bottom step of the memorial, 258.0 feet (78.6 m) WSW of the SW corner of the visitors center, and 2.0 feet (0.6 m) above the ground. The monument bears the inscription UNITED STATES COAST AND GEODETIC SURVEY BASIC BENCH MARK.

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BALTIMORE (FORT MCHENRY), PATAPSCO RIVER

Tidal datums at BALTIMORE (FORT MCHENRY), PATAPSCO RIVER are based on the following:

LENGTH OF SERIES	= 19 YEARS
TIME PERIOD	= 1960-1978
TIDAL EPOCH	= 1960-1978
CONTROL TIDE STATION	= 1st REDUCTION

Elevations of tidal datums referred to mean lower low water (MLLW) are as follows:

HIGHEST OBSERVED WATER LEVEL (08/23/1933)	= 7.90 FEET
MEAN HIGHER HIGH WATER (MHHW)	= 1.66 FEET
MEAN HIGH WATER (MHW)	= 1.35 FEET

MEAN TIDE LEVEL (MTL)	=	0.80 FEET
*NATIONAL GEODETIC VERTICAL DATUM-1929 (NGVD)	=	0.28 FEET
MEAN LOW WATER (MLW)	=	0.24 FEET
MEAN LOWER LOW WATER (MLLW)	=	0.00 FEET
BALTIMORE CITY DATUM (BCD)	=	-0.57 FEET
LOWEST OBSERVED WATER LEVEL (01/24/1908)	=	-4.90 FEET

*NGVD reference based on adjustment of 1972 AND NOS levels of 1984.

Bench mark elevation information:

ELEVATION IN FEET ABOVE:

BENCH MARK STAMP/DESIGNATION	MLLW	MHW
25 1919	6.16	4.81
27 1922	31.11	29.76
28 1922	7.14	5.79
29 1922	4.83	3.48
30 1922	9.46	8.11
31 1922	6.44	5.09
32 1922	6.49	5.14
35 1922	27.39	26.04
4680 A 1980	5.37	4.02
NO STAMPING 1	31.47	30.12

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BALTIMORE (FORT MCHENRY), PATAPSCO RIVER

Mean Sea Level (MSL) is a tidal datum determined over a 19-year National Tidal Datum Epoch. It pertains to local mean sea level and should not be confused with the fixed datums of North American Vertical Datum of 1988 (NAVD 88).

NGVD 29 is a fixed datum adopted as a national standard geodetic reference for heights but is now considered superseded. NGVD 29 is sometimes referred to as Sea Level Datum of 1929 or as Mean Sea Level on some early issues of Geological Survey Topographic Quads. NGVD 29 was originally derived from a general adjustment of the first-order leveling networks of the U.S. and Canada after holding mean sea level observed at 26 long term tide stations as fixed. Numerous local and wide-spread adjustments have been made since establishment in 1929. Bench mark elevations relative to NGVD 29 are available from the National Geodetic Survey (NGS) data base via the World Wide Web at www.ngs.noaa.gov.

NAVD 88 is a fixed datum derived from a simultaneous, least squares, minimum constraint adjustment of Canadian/Mexican/United States leveling observations. Local mean sea level observed at Father Point/Rimouski, Canada was held fixed as the single initial constraint. NAVD 88 replaces NGVD 29 as the national standard geodetic reference for heights. Bench mark elevations relative to NAVD 88 are available from NGS through the World Wide Web at www.ngs.noaa.gov

NGVD 29 and NAVD 88 are fixed geodetic datums whose elevation relationships to local MSL and other tidal datums may not be consistent from one location to another.

The Vertical Mark Number (VM#) and PID# shown on the bench mark sheet are unique identifiers for bench marks in the tidal and geodetic databases, respectively. Each bench mark in either database has a single, unique VM# and/or PID# assigned. Where both VM# and PID# are indicated, both tidal and geodetic elevations are available for the bench mark listed.

The NAVD 88 elevation is shown on the Elevations of Tidal Datums Table Referred to MLLW only when two or more of the bench marks listed have NAVD 88 elevations. The NAVD 88 elevation relationship shown in the table is derived from an average of several bench mark elevations relative to tide station datum. As a result of this averaging, NAVD 88 bench mark elevations computed indirectly from the tidal datums elevation table may differ slightly from NAVD 88 elevations listed for each bench mark in the NGS database.